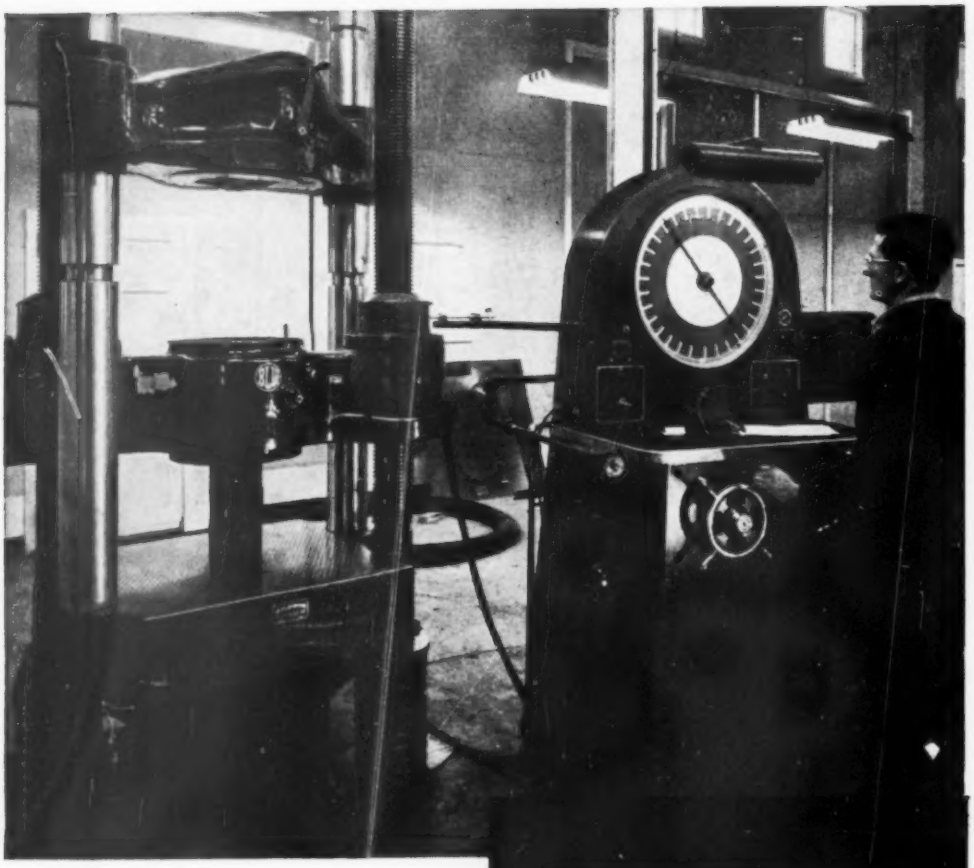
WATER & SEWAGE WORKS

AMERICA'S LARGEST MUNICIPAL ZEOLITE SOFTENING PLANT at La Verne Calif.

*Section 2 is the 1948 Index



ABOVE: Calibrating Testing Equipment at the Wharton Laboratory

ABOVE LEFT: Testing Concrete Cylinder for Compressive Strength

CONSTANT TESTING assures top quality

All materials used in the manufacture of Lock Joint Prestressed Concrete Cylinder Pipe are carefully tested to assure their uniformly high quality.

In Lock Joint's Laboratory at Wharton, New Jersey, accurately calibrated testing equipment checks the physical properties of all materials which constitute the finished product and test the physical characteristics of the completed pipe.

This constant check on all materials used in Lock Joint Pressure Pipe assures the top quality and long, useful service of the finished product.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PIPE COMPANY

P.O. Box 269, East Orange, N.J.

Pressure Pipe Plants:
Wharton, N. J. • Turner, Kan.

BRANCH OFFICES:

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Kenilworth, N. J. . . . Hartford, Conn.

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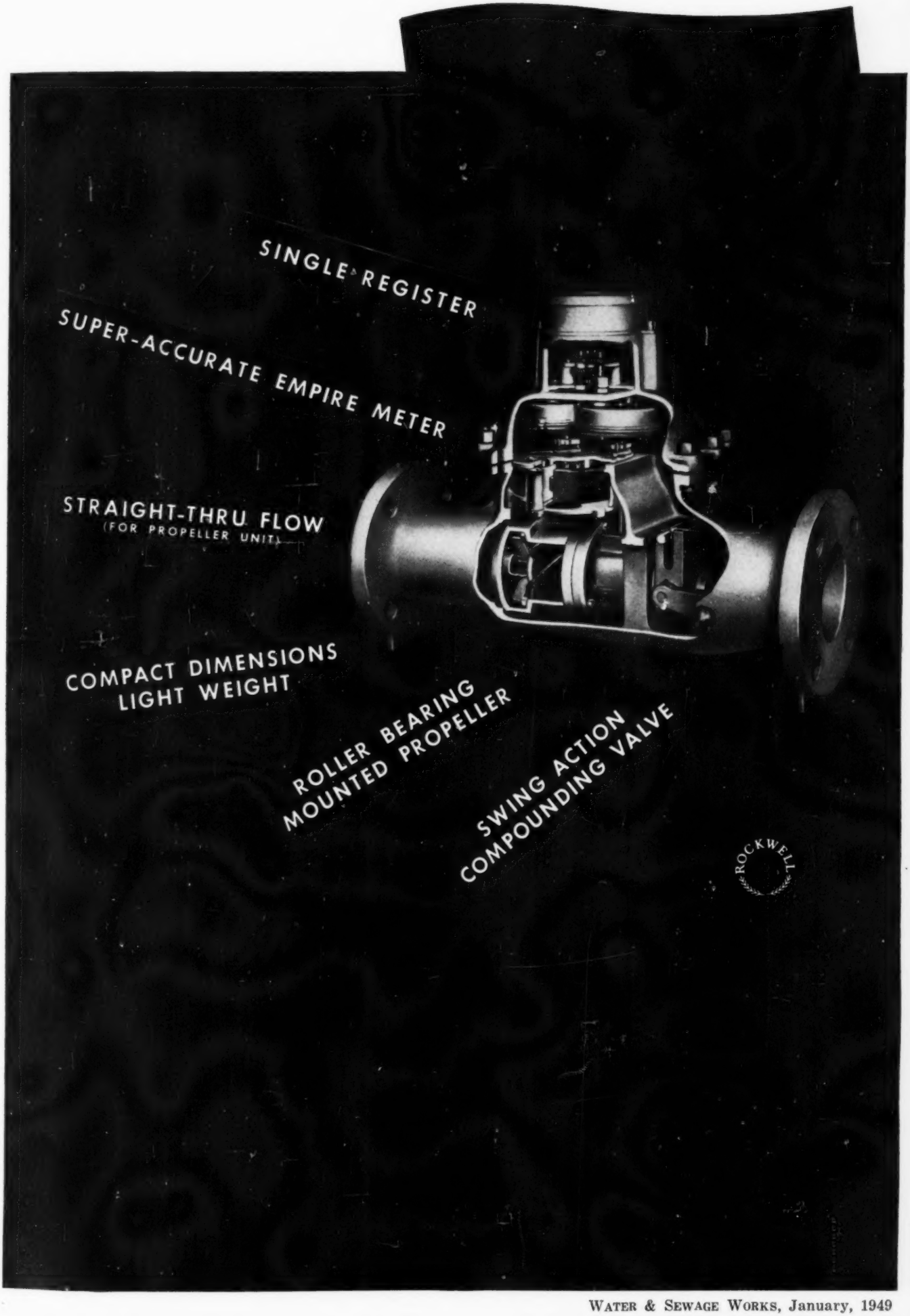
SINGLE REGISTER
SUPER-ACCURATE EMPIRE METER
STRAIGHT-THRU FLOW
(FOR PROPELLER UNIT)
COMPACT DIMENSIONS
LIGHT WEIGHT
ROLLER BEARING
MOUNTED PROPELLER
SWING ACTION
COMPOUNDING VALVE
ROCKWELL

Handy Hypo for Healthful Water

Hypo-chlorination with HTH is the handy "do-it-today" way to disinfect reservoirs, basins, flumes . . . to sanitize filters, tanks and aqueducts. Convenient HTH permits on-the-spot sterilization of newly-laid water mains and other strategic points in your water supply system. And when a main breaks, a flood strikes or other emergencies arise, HTH is on the job in a jiffy—*if* you have it on hand. So order your supply today . . . and write for the 1948 edition of Mathieson's factful booklet: "Hypo-Chlorination of Water". Mathieson Chemical Corporation, 60 East 42nd St., New York 17.

Mathieson
SANITATION HTH

Sanitation HTH . . . PH-Plus (Fused Alkali) . . . Liquid Chlorine . . . Chlorine Dioxide . . . Caustic Soda Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas Sodium Chlorite Products . . . Sodium Methylate

SANITATION HTH IS AVAILABLE IN CASES OF NINE HANDY 5-LB. CANS AND IN 100-LB. DRUMS.

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

This Month's Cover

Featured in this issue is the story of "Developments in the Water Works Field During 1948." One such development, now just under way, is the doubling in size of the softening-filtration plant of the Metropolitan Water District of Southern California. The plant softens and filters Colorado River water, employing the lime-zeolite process. The cover picture reveals the interior of the zeolite softening portion of the plant, which is being duplicated in the extension to provide 200 mgd. total plant capacity.

—*Photo courtesy The Permutit Co.*

Developments of the Year in Sewage Disposal and Industrial Waste Treatment

Will be reviewed in our February issue, as the feature of that issue. This year's reviewer needs no introduction to our older readers as the best posted individual in the sewage and industrial waste treatment fields, whose previous reviews have been acclaimed as meaty and readable as they are exhaustive. We are fortunate in having again secured for this exacting job

F. W. MOHLMAN, Ph. D.,
Chief Chemist, Chicago Sanitary District.

Financing of Distribution System Extensions

Is an authoritative discussion of an all important topic by a water works manager who presents a searching analysis of what comprises the *real* costs of providing extensions to existing water distribution systems and offers a realistic pattern for developing minimum charges to cover such extensions. Study this analysis by—

A. O. NORRIS, V.P. & Gen'l Mgr.,
The Birmingham (Ala.) Water Works Co.

European Sanitary Engineering Impressions

Will be related in a requested commentary from an international figure in the development of sewage and industrial waste treatment from "shovel and wheel-barrow" operations to the modern mechanized plant of today. The author who pioneered mechanical sewage treatment equipment, J. V. N. Dorr, having just returned from an extended European trip, has agreed to tell our readers something of his "European Sanitary Engineering Impressions."

Chemistry of Water Treatment

Is of particular interest to water purification engineers and chemists, but this series of papers on coagulation and water softening will be read with profit by any person in the field of water supply. These fundamental articles, the first three of which have already appeared, are the contribution of—

DR. A. P. BLACK,
Prof. of Chemistry, Univ. of Florida.
(Vice Pres. A.W.W.A.)

Operation of Small Filtration Plants

Is the subject of a current series of short articles dealing with the operation and maintenance of small filtration plants by an author who has had considerable experience—

A. E. CLARK, Gen'l Mgr.,
Nashville (Tenn.) Suburban Util. Distr.

Aerobic Treatment of Rum Wastes

By mixing them with sewage and passing them through a 2-stage Bio-filter proved successful in an experimental operation according to the results presented by—

C. N. SAWYER AND E. J. ANDERSON,
Sedgwick Labs., Mass. Inst. Tech.

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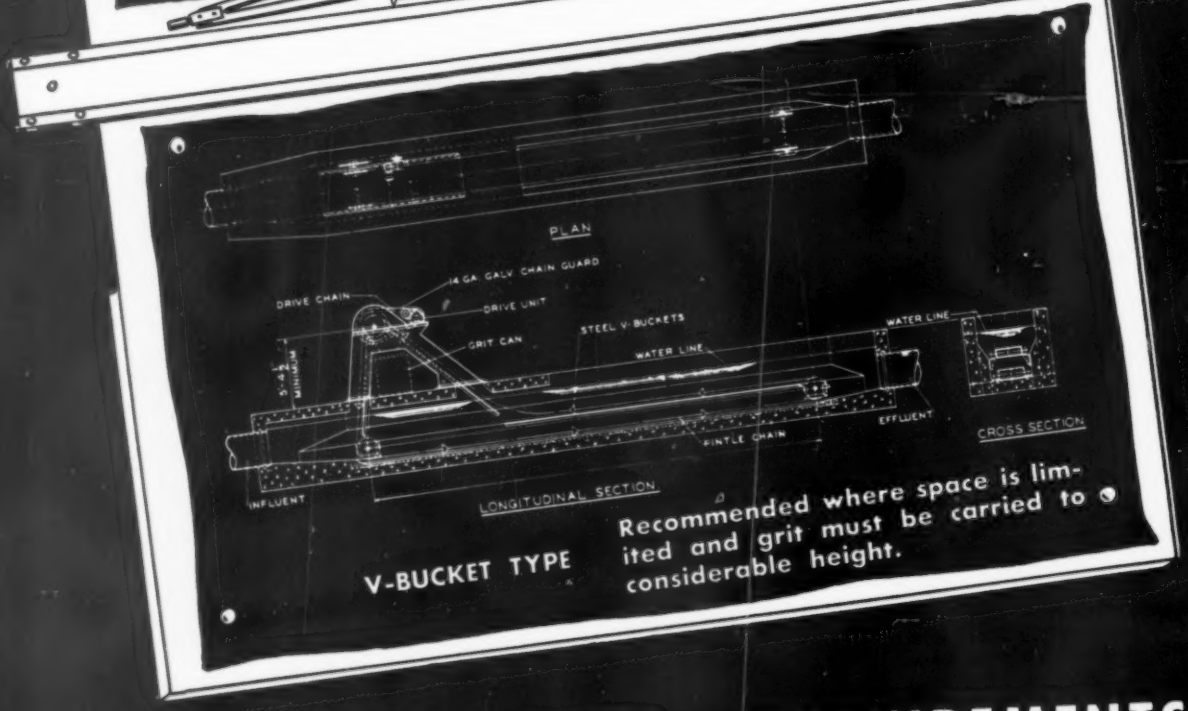
(Member—Audit Bureau of Circulation and Associated Business Papers.)

Jeffrey GRIT COLLECTORS

SCRAPER TYPE This type recommended for shallow channels. Length and width are variable.



V-BUCKET TYPE Recommended where space is limited and grit must be carried to considerable height.

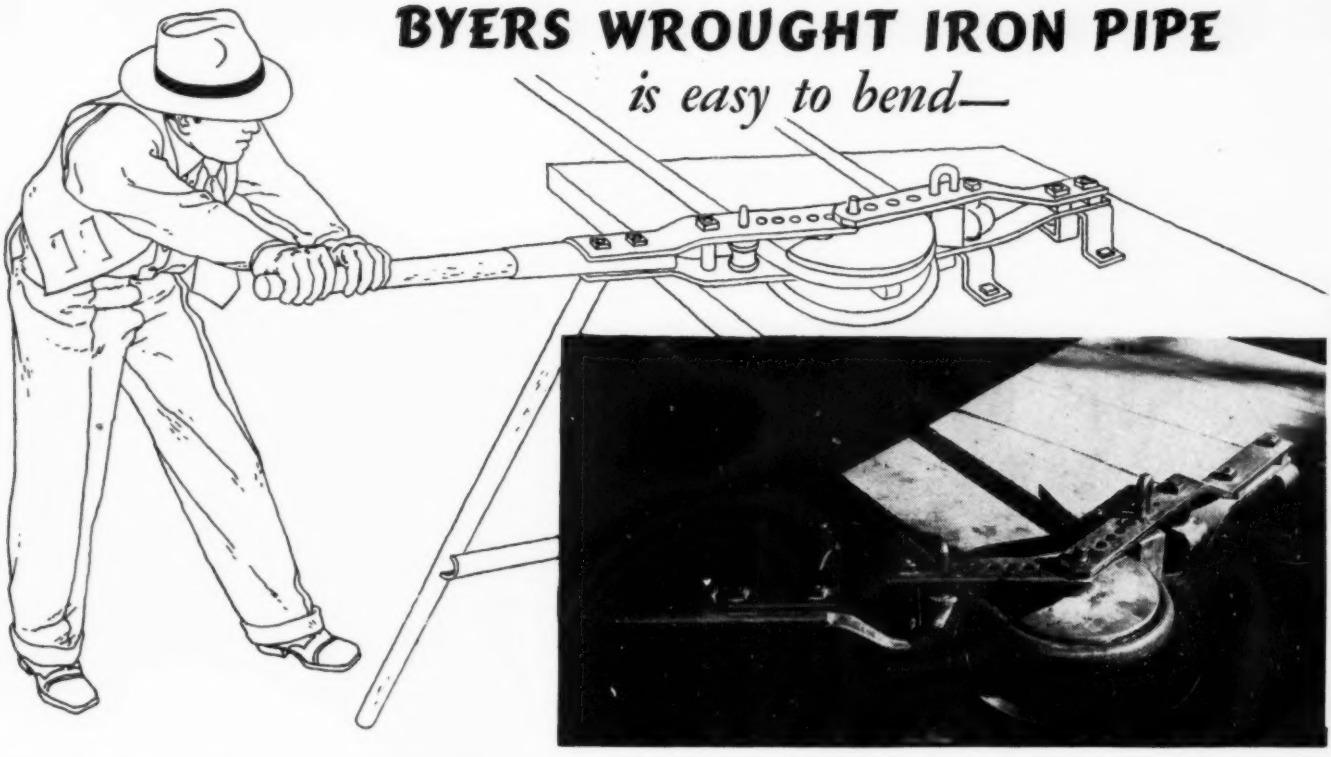
PLANNED TO MEET REQUIREMENTS

JEFFREY

ESTABLISHED 1877

BYERS WROUGHT IRON PIPE

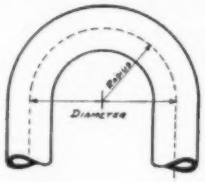
is easy to bend—



If you are installing continuous coils in a radiant heating system, or are required to bend pipe in connection with any type of system, you'll find that wrought iron —in addition to its corrosion resistance, fatigue resistance and weldability—has *ductility* that permits close bends to be readily made cold, with simple equipment.

Minimum Radii of Cold Bends

Some degree of flattening permitted



Size of Pipe	Minimum Radius of Bend Standard Weight	Extra Strong
3/8"	1.10"	1.10"
1/2"	1.40"	1.40"
3/4"	1.75"	1.75"
1"	2.15"	2.15"
1 1/4"	2.75"	2.75"
1 1/2"	3.50"	3.10"
2"	5.50"	4.60"

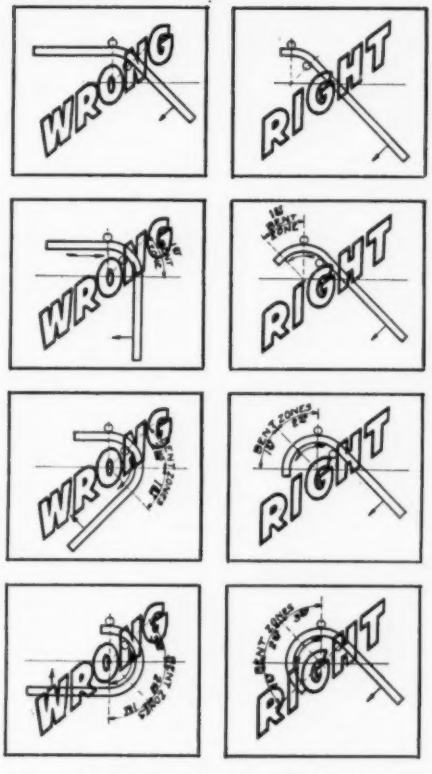
The minimum bend radii recommended for various sizes of Byers Wrought Iron pipe, both standard weight and extra strong, are shown in the table.

In bending wrought iron pipe, three fundamental requirements should be observed. (1) The force should be applied as a slow, steady pressure—to permit the material to flow. (2) The bending stress should be applied successively to short sections of the pipe. And, (3) the bent or stretched portion should be advanced *out* of the bending zone, so as not to be subjected to further stress. The small diagrams at right illustrate the wrong and correct methods.

For large-radius bends the conventional pipe bending tables, employing pins, are satisfactory. For the production of close radii bends, however, it is desirable to employ some form of mechanical pipe bending device. In several instances, customers have used "homemade" equipment with good results, but a number of makes and models of inexpensive pipe benders for field and shop use are available, and generally prove a good investment.

Our bulletin, "The Bending and Flanging of Wrought Iron Pipe" discusses both the principles and practice of cold and hot pipe bending. If you would like a copy for your file, or to pass on to your workmen, we will be glad to supply you.

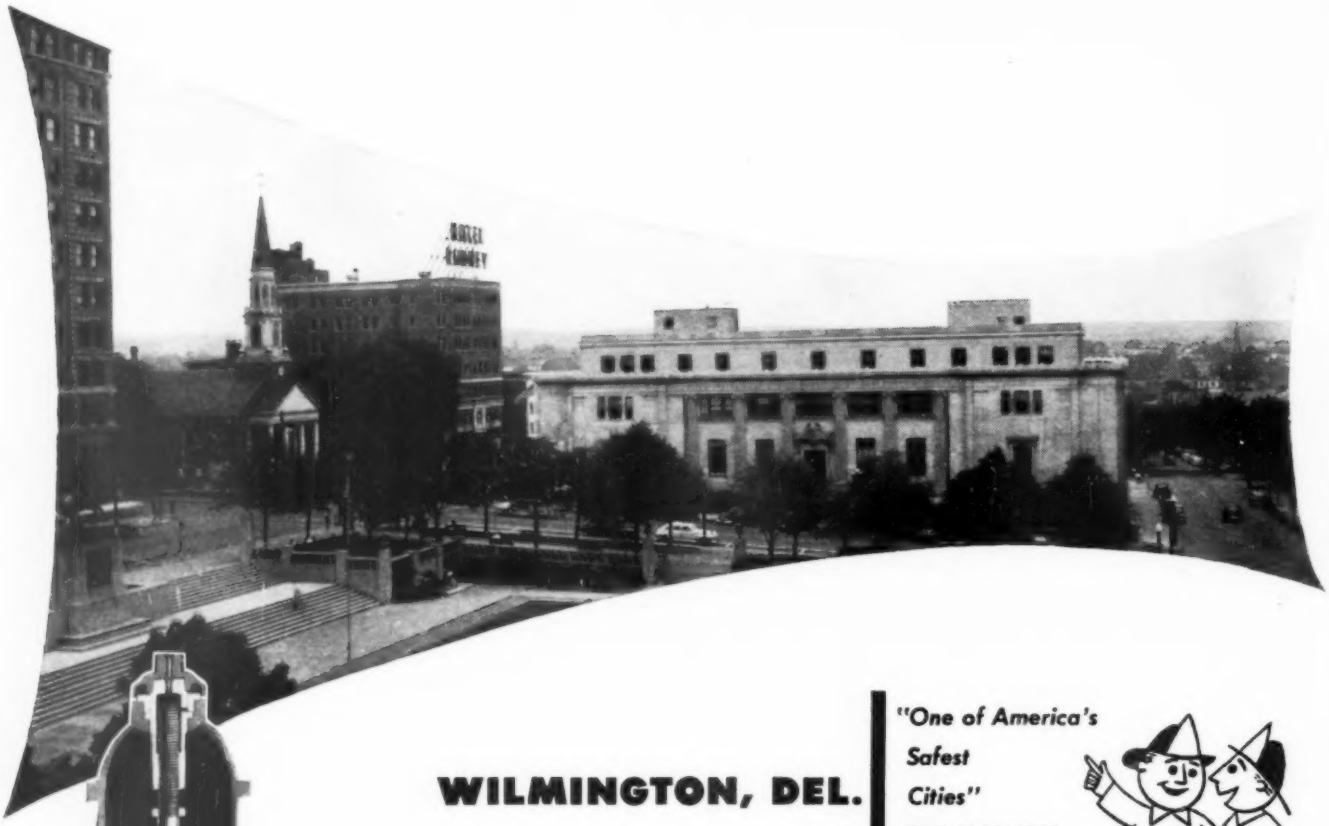
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

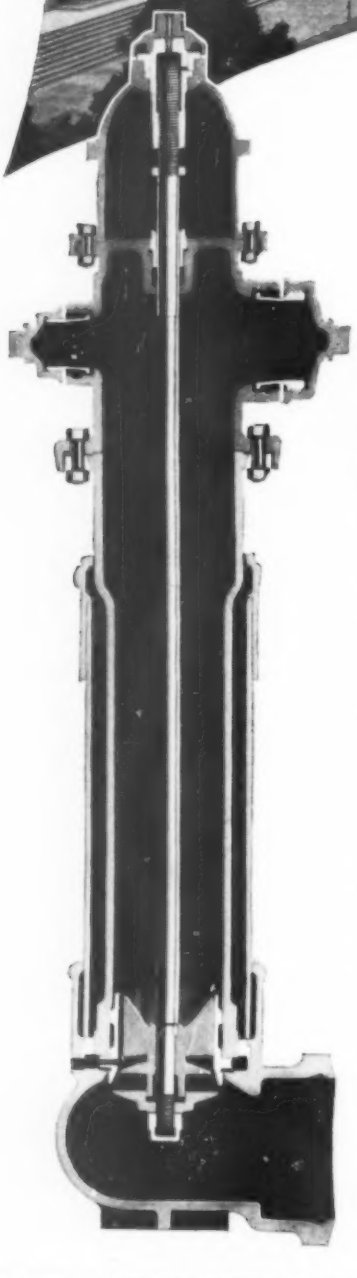


Here original bent sections are stressed when successive bends are made.

Here bent sections advance out of bending zone, are not subjected to further stress.

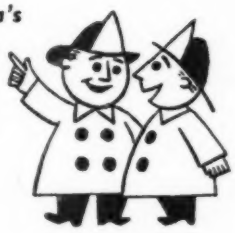
CORROSION COSTS YOU MORE THAN WROUGHT IRON





WILMINGTON, DEL.

"One of America's Safest Cities"
THE MATHEWS FIREMEN SAY



SIMPLE LOGIC! For Wilmington is protected by Mathews Modernized Hydrants, which means safety plus—for two big reasons. First, the hydrant need not be out of commission long in case of an accident. All the working parts are contained in a removable barrel which can be replaced in a few minutes without excavating.

Secondly, Mathews are designed for troublefree service—as generations of use have proved. Water cannot reach the thread and rust it. A shield operating nut, capping the revolving nut, keeps out rain and dust and provides free, quick action at all times. These and other features combine to make a hydrant in which there is just about *nothing to go wrong*.

The welfare of your community is your highest public interest. Send for descriptive literature and read in detail how the Mathews Modernized Hydrant can furnish the safety plus you are looking for.

OTHER MATHEWS FEATURES: Head can be turned 360° • Replaceable head, nozzle outlets easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity Operating thread only part to be lubricated • A modern barrel makes any Mathews Hydrant good as new • Low maintenance cost

MATHEWS HYDRANTS

***Made by* R. D. WOOD COMPANY**

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Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

"well pleased and proud of its appearance"

Illinois Water Service Co.
Pontiac, Illinois

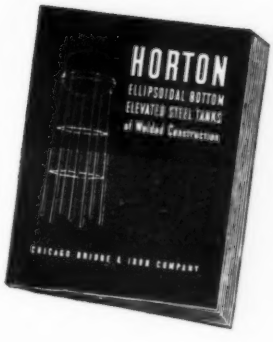
THE 500,000-gal. Horton elevated water tank shown at the left was recently erected at Pontiac, Illinois, to provide gravity pressure in the distribution system. The statement at the top of this page is typical of how many users feel about Horton elevated water tanks.

Since the installation of this tank, water pressure in the distribution system has remained practically constant at 52 lbs. per sq. in. More uniform water pressure is only one of the many benefits provided by elevated storage. Others include more dependable supply of water for fire protection, lower insurance rates, maintenance of pressure during temporary power failure and lower pumping costs.

Horton elevated tanks are built in the Horton ellipsoidal—bottom or the radial—cone bottom design, in a wide range of capacities. When your plans call for elevated water storage tanks for either municipal or industrial service, write our nearest office for estimating figures on Horton tanks.

NEW BULLETIN ON HORTON TANKS

This illustrated bulletin describing Horton elevated tanks is now available from our nearest office. It contains information on the design, construction, and use of Horton tanks in both municipal and industrial installations. Write for a copy today.



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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

THE MEMBERSHIP OF A
C. I. P. Century Club now has

The Cast Iron Pipe Century Club is probably the most unique club in the world. Membership is limited to municipal, or privately-owned, gas and water supply systems having cast iron mains in service for a century or more.

Although the Club is formally established, there are no dues, no regular meetings, and no obligation other than to inform the Recording Secretary if and

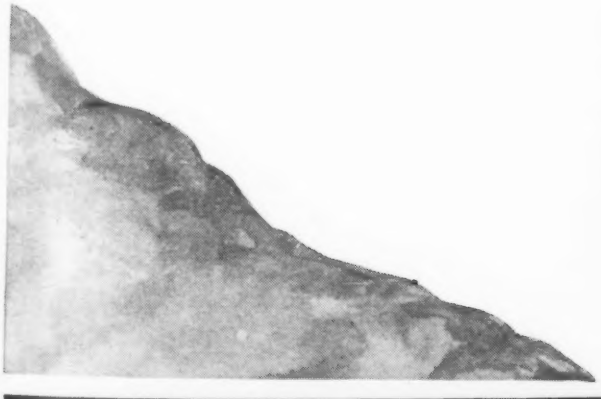
CAST IRON PIPE

DISTINGUISHED CLUB...
23 Members!

when the qualifying gas or water main is taken out of service, or, sold for re-use.

In spite of the unique requirement for membership, the Club roster grows, year by year. And why not, when answers to a questionnaire, mailed to gas officials in 43 large cities, show that *original* cast iron mains are still in service in 29 of the cities. And a survey sponsored by three water works associations, indicates that 96% of all 6-inch and larger cast iron water mains ever laid in America are still in service.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.



CLUB ROSTER

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CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO.
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BOSTON CONSOLIDATED GAS CO.
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Philadelphia, Pennsylvania

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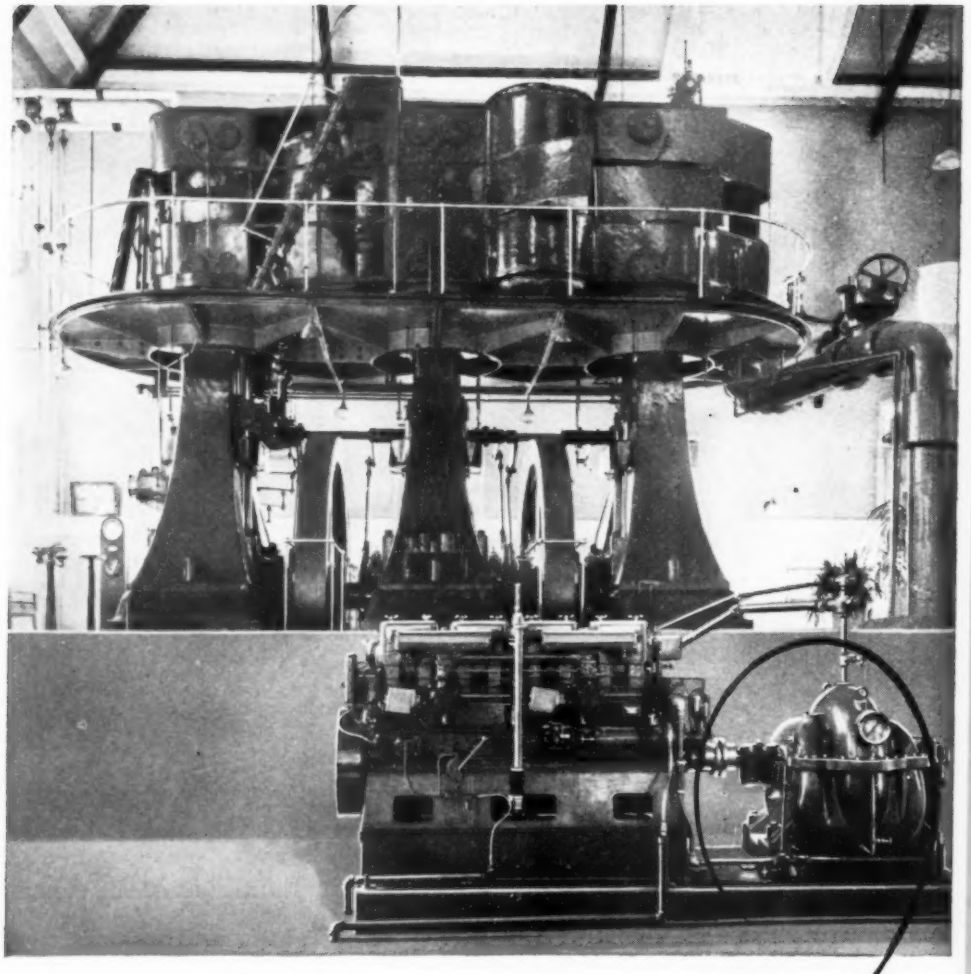
CITY OF WHEELING WATER DEPT.
Wheeling, West Virginia

YORK WATER COMPANY
York, Pennsylvania

SERVES FOR CENTURIES



New De Laval Centrifugal Pump

REPLACES OBSOLETE GIANT

as Atlantic City modernizes

Replacement of the old triple-expansion pumping engine, shown in the background with the new De Laval centrifugal pump in the foreground, is part of the modernization program for Atlantic City. This station now employs a total of seven De Laval centrifugal pumps having a combined capacity of more than 73 million gallons daily. Four of these are motor-driven pumps employed for practically continuous operation while three are gasoline engine-driven pumps employed for stand-by service. All seven units are equipped with self-priming systems so that they can pick up the load upon a minute's notice.

DE LAVAL

DE LAVAL STEAM TURBINE CO., TRENTON 2, N.J.

Atlanta • Philadelphia • Los Angeles • Chicago • Pittsburgh • San Francisco
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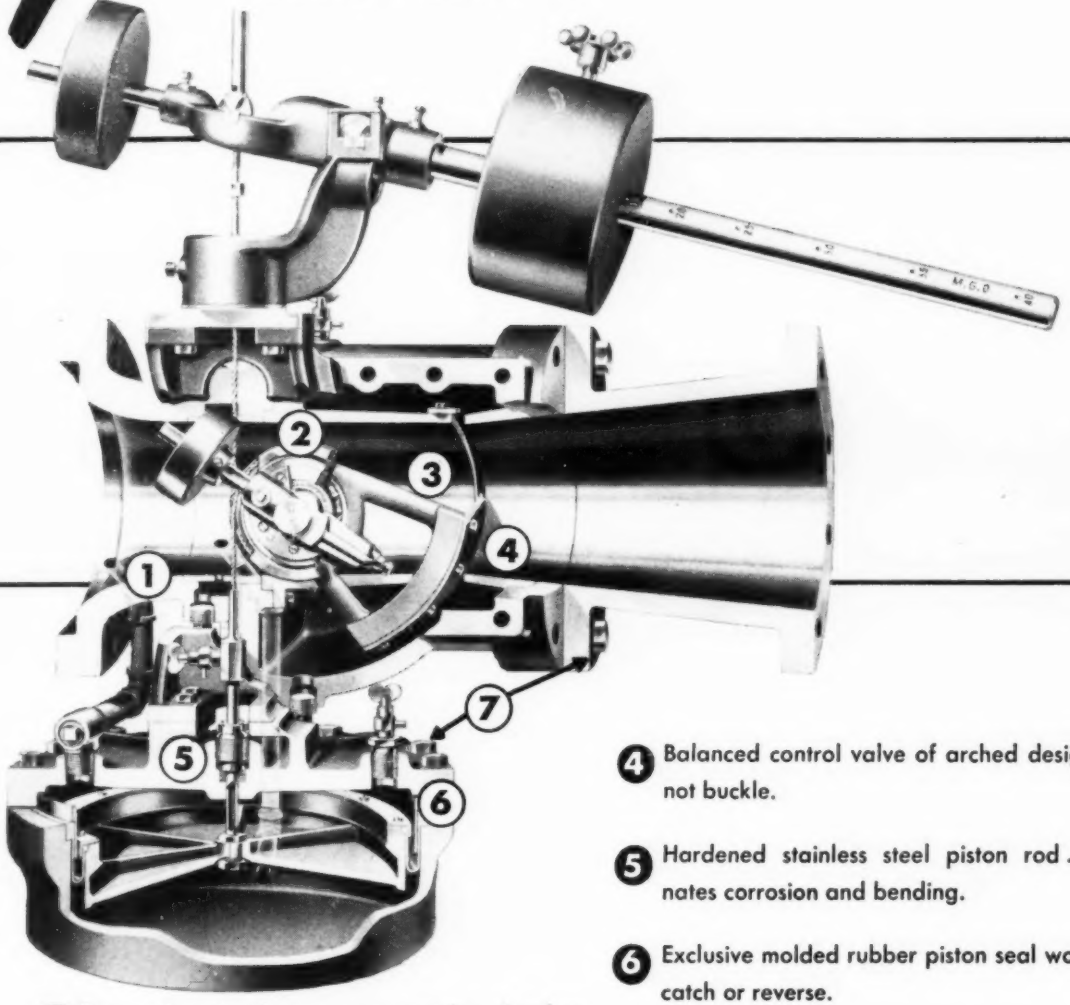
WW-6

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

7 GOOD REASONS

why more engineers, who demand the best in water works rate controllers, are specifying . . . "equal to Builders Model RCE":



1. Bronze throat with pressure-averaging chamber for greater accuracy.
2. Anti-friction bearings throughout: quick response to slightest change in flow.
3. Valve path entirely clear of air pockets — prevents "hunting".
4. Balanced control valve of arched design — will not buckle.
5. Hardened stainless steel piston rod . . . eliminates corrosion and bending.
6. Exclusive molded rubber piston seal won't bind, catch or reverse.
7. And something extra, — Everdur bronze bolts for easy maintenance.

For Bulletin 321B, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 10 Codding Street, Providence 1, R. I.

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Venturi, Propeloflo and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyoflo Meters Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Filter Operating Tables • Manometers Chronoflo Telemeters

BUILDERS PROVIDENCE *Instruments*

When APPEARANCE is a factor... joined with sound efficiency and economy in MODERN WATER STORAGE...

Specify

TUBULAR COLUMN TOWER

ELEVATED STEEL TANKS

by **PITTSBURGH •DES MOINES**

Architecturally handsome appearance, complementing the character of high-value districts, is a *plus* advantage of our Tubular Column Tower elevated steel tank design.

Furnished in double-ellipsoidal or toroidal-bottom types, these tanks are available in a wide range of capacities for every community demand—providing better water service at lower cost, with attractive aspect in any locality. *Write for a consultation.*

UPPER PHOTO
This 60 ft. diameter toro-ellipsoidal tank stores 500,000 gallons of water within a 25'0" head range. Height from foundation top to tank bottom is 100'0".

LOWER PHOTO
500,000 gallons of water are stored 92'10" above foundation tops in this 50'0" diameter double-ellipsoidal type tank, having a head range of 39'2".

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH.....3418 Neville Island
NEW YORK.....Room 918, 270 Broadway
CHICAGO.....1222 First National Bank Building
DES MOINES.....919 Tuttle Street
DALLAS.....1223 Praetorian Building
SEATTLE.....926 Lane Street
SANTA CLARA, CAL.....625 Alviso Road

DOES LIMBURGER HAVE "Taste" OR "Odor"?

There has been considerable controversy over whether a substance has 'taste' or 'odor', or both. Some psychologists and physiologists claim that there are only four fundamental tastes: salty, sweet, bitter and sour. They maintain that all other so-called 'tastes' are in reality 'odors', and affect only the sense of smell. Water works operators who use Aqua Nuchar Activated Carbon don't have to debate whether water has 'taste' or 'odor'. They know that by using Aqua Nuchar, unwanted tastes and odors are removed by *ad*sorption. Nuchar's action is purely *physical*, so that odors are actually taken out of the water, rather than changed by chemical reaction.

When unpleasant tastes and odors in the water supply reach the consumer, he reaches for his phone to complain to the water department. In more than 1200 communities Aqua Nuchar Activated Carbon has been used to eliminate customer kicks by removing the odorous substances from the water.

Aqua Nuchar stocks are available in key cities throughout the United States. Write today for your data file on purification through *ad*sorption.

INSURES PALATABLE NUCHAR AQUA DRINKING WATER

industrial CHEMICAL SALES

division west virginia pulp and paper company

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230 PARK AVENUE
NEW YORK 17, N. Y.

PURE OIL BLDG
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CHICAGO 1, ILLINOIS

PUBLIC LEDGER BLDG.
INDEPENDENCE SQUARE
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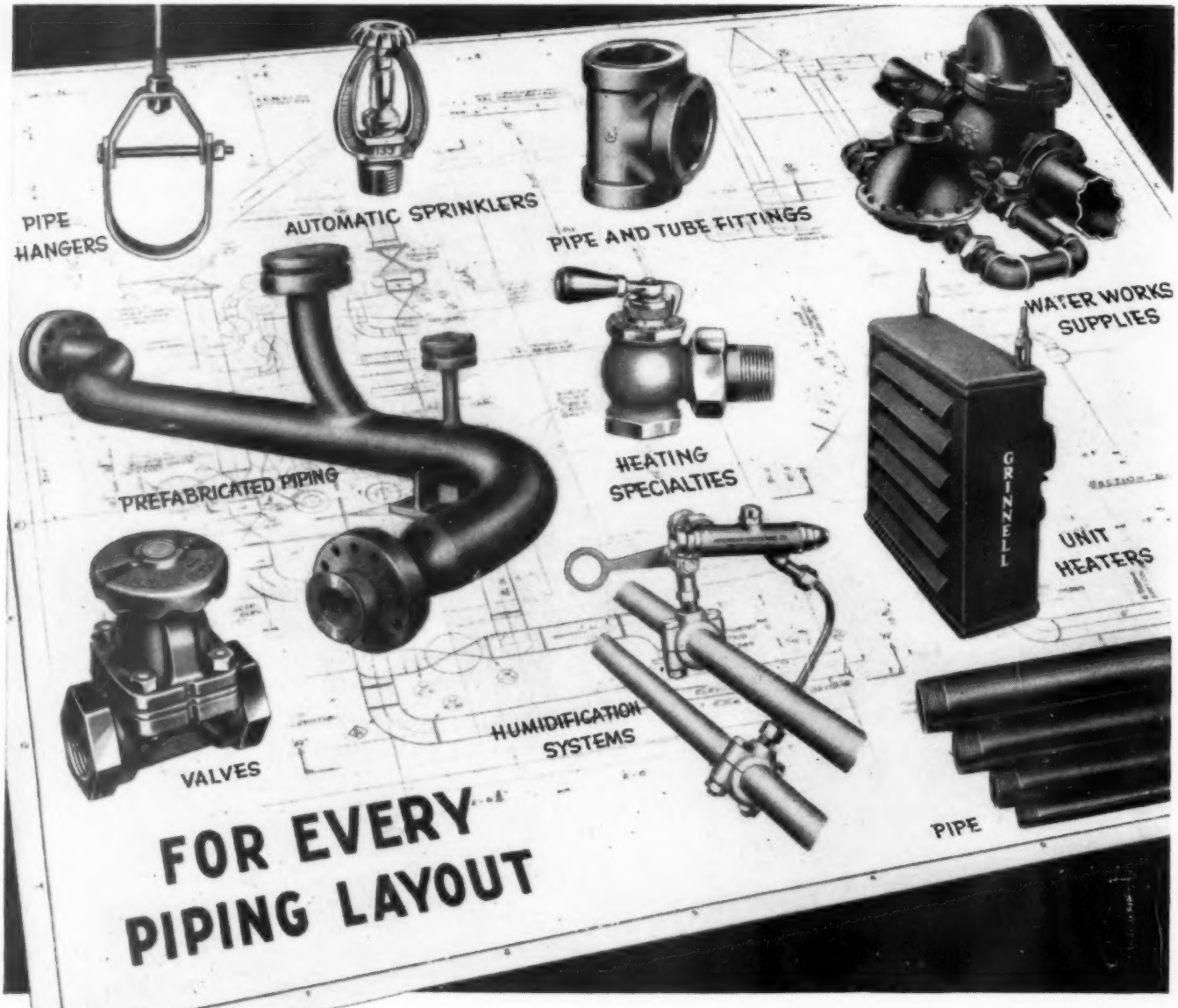
LEADER BLDG.
526 SUPERIOR AVE., N.W.
CLEVELAND 14, OHIO

OTHER PRODUCTS: Snow Top Precipitated Calcium Carbonate • Nuchar Activated Carbons • Liqro Crude Tall Oil • Tallene Tall Oil Pitch • Indusoil Distilled Tall Oil • Tallex Abietic Acid • Sulfate Wood Turpentine • Alpha Pinene • Beta Pinene • Polycel Cellulose Fibers • Indulin (Lignin)



GRINNELL PROVIDES

THE PRODUCTS . . .
THE FACILITIES . . .
THE EXPERIENCE

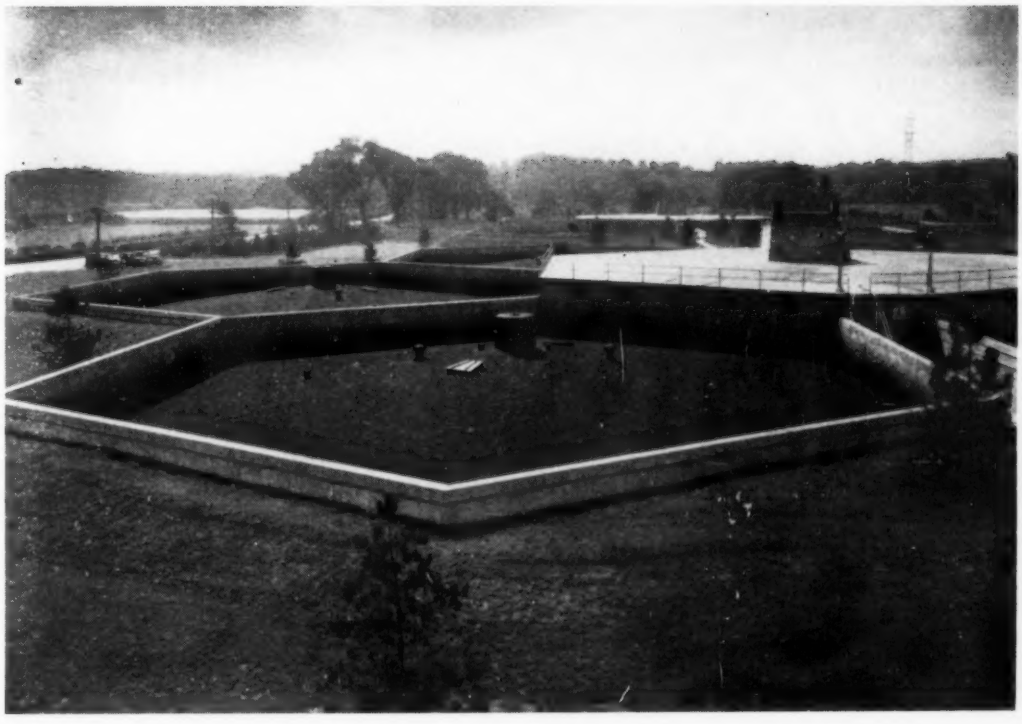
Whether your piping layout involves installing simple water and air lines, protecting buildings from fire, supplying heat or humidification or transporting steam under 1,500 lbs. pressure, Grinnell provides the products, facilities and the experience for a *complete one-stop piping service.*

Grinnell manufactures a broad line of piping products and carries a complete stock of pipe, valves, fittings and piping specialties in strategically located branch warehouses . . . supplies prefabricated piping sub-assemblies ready to install . . . can help you engineer your piping system.

99 YEARS — WHENEVER PIPING IS INVOLVED

GRINNELL

Grinnell Company, Inc., Providence 1, Rhode Island. Branches: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston Long Beach • Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



Twelve PFT 95' Hexagonal Floating Covers at Cleveland's Easterly Project. In operation since 1936, they provide 2,000,000 cubic feet of efficiently operating digester capacity. Havens and Emerson, Consulting Engineers, Cleveland.

OVER 40,000,000 CUBIC FEET OF DIGESTER TANK VOLUME SERVED BY P.F.T. FLOATING COVERS

Included in this total volume handled by modern "Controlled Digesters" are many of the country's larger installations such as that at Cleveland, Ohio, shown above; New York City's Tallman Island, Bowery Bay and Coney Island Plants; Boston, Massachusetts; Philadelphia, Pa.; Buffalo, New York; Fort Wayne, Indiana; Des Moines, Iowa; Denver, Colorado; and Stockton, Calif. This country-wide acceptance of PFT Floating Covers insures safe, troublefree and efficient operation of the sludge handling facilities at these plants serving over 15,000,000 of the country's population.

Floating covers are only one result of PFT's constant striving to provide SAFE SANITATION for an entire nation. Since its founding in 1891, PFT engineers, through research and development in sewage treatment methods, have been, and are continuing to lead the way to a truly "Sanitary America."

PFT products include Floating Covers, Digester Heaters and Heat Exchangers, Gas Safety Equipment, Supernatant Liquor Selectors and Gauges, Rotary Distributors, Fixed Nozzle Filter Equipment, and Air Diffusion Equipment. Write for bulletins.

P.F.T.

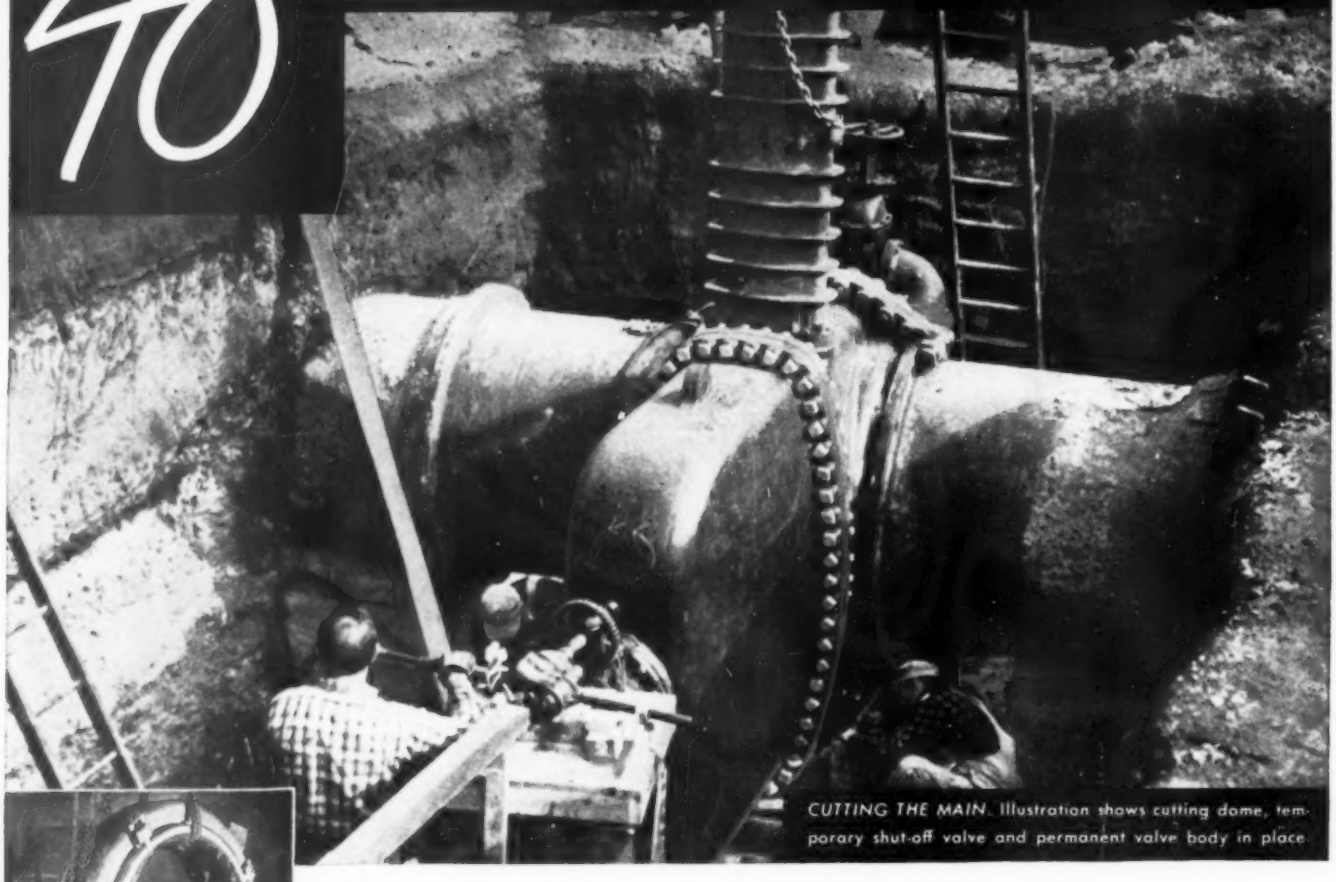
PACIFIC FLUSH TANK CO.

SEWAGE TREATMENT EQUIPMENT EXCLUSIVELY SINCE 1893

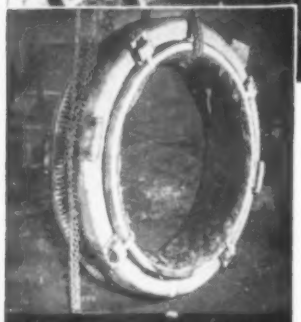
4241 RAVENSWOOD AVENUE CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • DENVER • TORONTO

48"* GATE VALVE INSERTED UNDER PRESSURE
to Avoid Stoppage of Steel Production



CUTTING THE MAIN. Illustration shows cutting dome, temporary shut-off valve and permanent valve body in place.



Section removed from main.

Finished insertion

At a large Eastern steel mill uninterrupted production depended upon a thirty year old, 48" cast iron main, carrying sea water used for cooling the furnace jackets. The main was in poor condition — badly corroded and electrolytically pitted.

In order to provide an emergency by-pass in the event of line failure, a gate valve was required. Since the mill could not risk even a momentary shut down, Smith was asked to insert the valve under pressure. Although of unprecedented size, the insertion was completed in four days without interruption of service or reduction in pressure.

*First 48" insertion ever made under pressure. One month later a second 48" gate valve was inserted by Smith for the Water Bureau, Philadelphia, Pa.

29

GATE VALVES
CHECK VALVES
FIRE HYDRANTS
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.
ESTABLISHED 1896
EAST ORANGE, NEW JERSEY

FLOOR STANDS
INDICATOR POSTS
TAPPING MACHINES
INSERTING MACHINES
PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES

Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

The Inyokern Earthquake

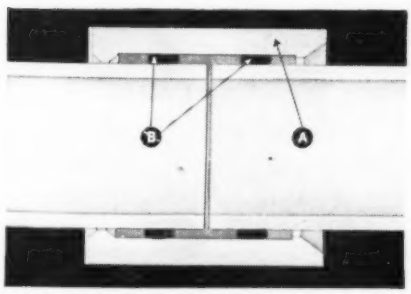
WATER LINES are seldom required to withstand a test as severe as that to which a Transite* asbestos-cement Pipe installation was subjected at Inyokern, California, about two years ago. The Transite installation at Inyokern consists of over 300,000 feet of pipe and comprises the major portion of the water supply system for the vast Naval Ordnance Test Station located there.

During the early part of 1946, an earthquake of maximum intensity occurred in the Inyokern area. Shocks of great severity were felt throughout the immediate locality in which the Transite line was laid. Naturally, concern was felt at the Naval establishment for the safety of its water supply.

After the quake had subsided, crews were dispatched to repair whatever damage the lines might have suffered. A thorough search failed to reveal a single break or any evidence of leakage at any one of the 25,000 joints in the system. Subsequent careful check of pressures and measurement of water levels confirmed that the lines had remained intact.

This aerial view shows a portion of the Naval Ordnance Test Station at Inyokern, California.

The reason this Transite installation was able to withstand this severe test is found in the inherent strength of the pipe and in the design of its Simplex Coupling, the standard coupling for Transite Pressure Pipe. Each of these couplings is a tight yet flexible link connecting one section of pipe to another and imparting to the line as a whole a degree of flexibility which enables it to "roll with the punch." Thus, shocks and vibrations are absorbed, stresses minimized to an unusual degree.



This cutaway sketch shows construction of the Simplex Coupling used with Transite Pressure Pipe. It consists of Transite sleeve "A" and two rubber rings "B" which are tightly compressed between sleeve and pipe as the coupling is assembled.

A factory-made joint which requires only assembly on the job, the Simplex Coupling derives its flexibility from its simple design. Consisting of a Transite sleeve and two rubber rings tightly compressed between pipe and sleeve, its simplicity and ease of assembly are apparent from the accompanying illustration. Moreover, this coupling is readily checked for proper assembly as the line is laid—further assurance of tightness in each individual joint and in the line as a whole.

Probably your water lines will never be called upon to absorb punishment as severe as the Transite lines at Inyokern. But the same engineering advances which protected this Transite installation can be depended on to safeguard equally well against the stresses normally encountered in water line service.

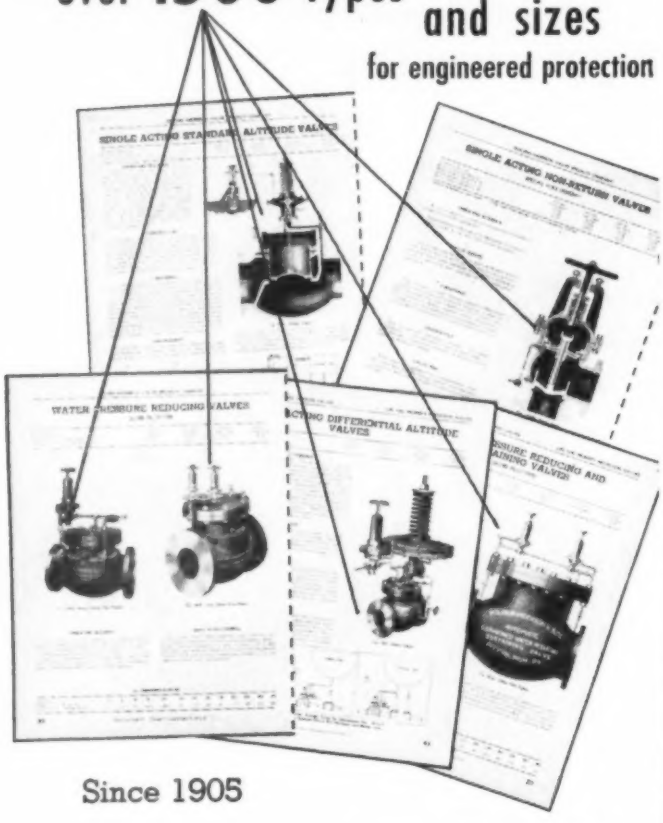
For further information about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

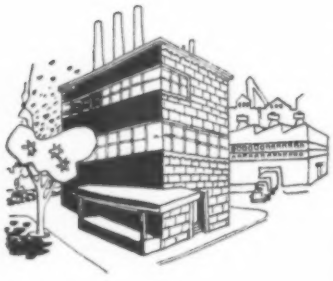
*Transite is a registered Johns-Manville Trade Mark

Golden-Anderson VALVES

over 1500 types and sizes for engineered protection


SINGLE ACTING STANDARD ALTITUDE VALVES
SINGLE ACTING NON-RETURN VALVES
WATER PRESSURE REDUCING VALVES
ACTING DIFFERENTIAL ALTITUDE VALVES
PRESSURE REDUCING AND SUSTAINING VALVES

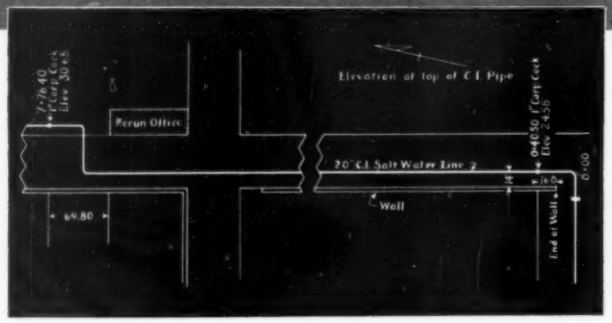
Since 1905



For more than 35 years Valves by Golden-Anderson have proven satisfactory in the protection of life and property. Engineer-designed to give safe, dependable control under even the most difficult and adverse conditions. For complete informative and technical data, send our engineering department your most difficult assignment.

GOLDEN-ANDERSON
VALVE Specialty Company
Keenan Building • Pittsburgh 22, Pa.

A SURVEY WAS CONDUCTED ...A Report Was Made



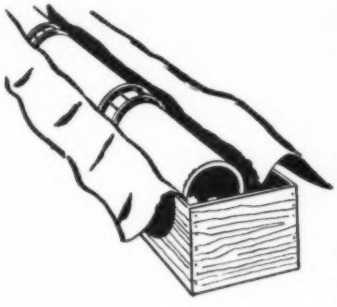
The following are excerpts taken from an actual report of an engineering survey made by the Pittsburgh Pipe Cleaner Company for an Eastern refinery.

The test of this 20" salt water line Indicated a Williams & Hazen coefficient of "C" = 58, which is sufficiently low to reveal a serious need of rehabilitation. The present delivery of this line is 8.34 M.G.D. If rehabilitated, the Williams & Hazen "C" value would conservatively be raised to 120, with an increase in flow under existing pressure conditions to 17 M.G.D.

Result of Tests:

Date of test	September 18, 1948
Length of main Sta 0 + 40.50 to 11 + 07	1066′
Equivalent length of two 90° bends	100′
Total equivalent length tested	1166′
Flow in line during test	8.34 M.G.D.
Loss of head in 1166′	28′
Williams & Hazen formula "C" =	58
Calipered diameter:	
Sta 0 + 40.5	19 3/16"
Apparent thickness of incrustation	3/8"
Sta 11 + 07	19 7/16"
Apparent thickness of incrustation	9/32"
Velocity coefficients determined by traverse along diameter:	
Sta 0 + 40.5	.80
Sta 11 + 07	.82

PITTSBURGH PIPE CLEANER CO.
133 Dahlem St., Pittsburgh 6, Pa.
BALTIMORE BIRMINGHAM BOSTON BRADENTON, FLORIDA
BUFFALO CHARLOTTE CHICAGO CINCINNATI DETROIT
HOUSTON NEW YORK PHILADELPHIA ST. LOUIS



It's like buying a packaged pipeline!

Installing a Dresser-Coupled steel line is so simple that it's almost like taking a pipeline out of a package. You use plain-end steel pipe just as it comes from the mill—assemble it with Couplings just as they come from the factory—ready-made, fully tested, all set to go.

Both the pipe and the pipe joint are factory-made under ideal conditions. There's no field fabrication, nothing to go wrong. Any workman can make the joints and produce a strong, flexible line—permanently bottle-tight. The only tool needed is a wrench.

Installation progresses rapidly, day or night, rain or shine. You need no special equipment to join this kind of line, and backfilling can follow closely behind the laying crew. This eliminates the hazards of open ditches.

When you use Dresser Couplings you get the full, life-long advantage of glass-smooth modern pipe linings. There can be no damage to the lining because no heat is used at the joint, and there is no need for men to enter the pipe.

For speedy installation, top performance and an extra margin of safety, specify a Dresser-Coupled steel pipeline. Write for information.

SIMPLE • FAST
FLEXIBLE • PERMANENT

Even in cramped quarters, Dresser Style 38 Couplings make permanently tight, flexible joints every time.

Partial list of cities using Dresser-Coupled steel lines

Albuquerque, N.M.	Denver, Colo.	Milwaukee, Wisc.	Saginaw, Mich.
Boston, Mass.	Detroit, Mich.	Newark, N. J.	Savannah, Ga.
Chicago, Ill.	Harrisburg, Pa.	New York, N. Y.	Syracuse, N. Y.
Cleveland, Ohio	Kansas City, Mo.	Philadelphia, Pa.	Yakima, Wash.

DRESSER COUPLINGS

ONE OF THE DRESSER INDUSTRIES

Dresser Mfg. Division, 59 Fisher Ave., Bradford, Pa. • In Texas: 1121 Rothwell St., Houston • In Canada: 60 Front St., W., Toronto

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE.—P. O. BOX 14, MEMPHIS 1, TENNESSEE

THE SILENT WATCHMAN

REPRESENTATIVES IN THE FOLLOWING CITIES:

SALT LAKE, UTAH Box No. 1202
DETROIT, MICH. Box No. 1423
RALEIGH, N. C. Box No. 251
SYRACUSE, N. Y. Box No. 681
BUTTE, MONTANA Box No. 383
GREENVILLE, S. C. Box No. 1074
TAMPA, FLORIDA Box No. 1642
RICHMOND, VA. Box No. 886
NEWARK, OHIO Box No. 623
FARGO, N. D. Box No. 1472
COLUMBIA, S. C. Box No. 472
DALLAS, TEXAS Box No. 1881
DENVER, COLO. Box No. 2037
WAUSAU, WIS. Box No. 682
SAN FRANCISCO, CAL. Box No. 1445
COLUMBIA, MO. Box No. 522
SPOKANE, WASH. Box No. 906
MACON, GEORGIA Box No. 402
PROVIDENCE, R. I. Box No. 202

Complete Service for Elevated Water Tanks—

30 Years Experience

BE SAFE DON'T GAMBLE!

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress.

On completely re-conditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

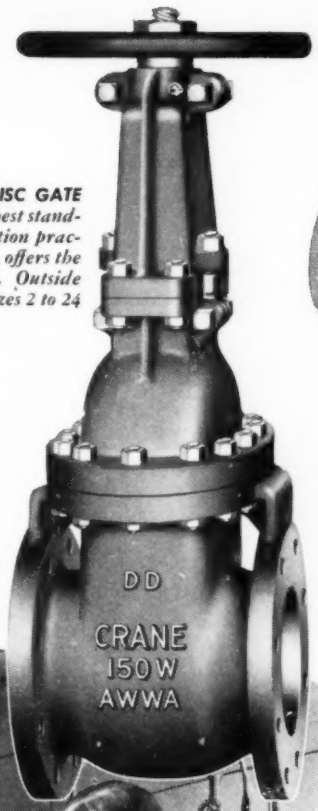
Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

COPYRIGHT, 1947

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST



A.W.W.A. IRON BODY DOUBLE DISC GATE VALVES *by Crane meet today's highest standards of water supply and distribution practices. Crane No. 2495, shown here, offers the best valve performance in its class. Outside screw and yoke; flanged ends; in sizes 2 to 24 inches. See your Crane Catalog.*

MOTOR OPERATED CONTROL VALVES *to mains in a large pumping station. The Crane line includes valves of all types and sizes.*

why do you find

CRANE VALVES

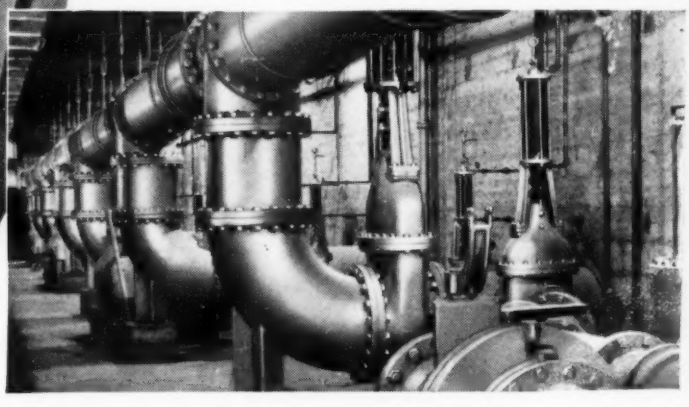
wherever flow is controlled?

BECAUSE their record for dependable performance is second to none. Operating under a variety of conditions, Crane valves have for generations given municipalities the trouble-free service that minimizes repair and replacement costs.

BECAUSE wherever valves are needed—in water works, sewage disposal plants or water distribution systems—large or small—the complete Crane line is most likely to include the valves and accessories you need. And no matter what size or type of valve you choose—it's Crane Quality, it's sure to stay on the job of maintaining water utilities at peak efficiency.

CRANE CO., 836 South Michigan Avenue
Chicago 5, Illinois
Nation-Wide Service
Through Branches and Wholesalers

MAIN PIPE GALLERY *in new municipal water treatment plant equipped with Crane 8-in. re-wash valves, 14-in. effluent valves and 24-in. wash valves—all cylinder operated.*



VALVES · FITTINGS · PIPE

CRANE

PLUMBING AND HEATING

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your business.*

Where are next year's profits coming from?

LABOR COSTS probably won't be any lower. Most materials, when you can get them, will still be costly. Yet no one in his right mind believes that profits can come from higher and higher prices. For that just makes *everybody* the loser in the end.

So the answer you hear most often is for all of us to *produce* more. To produce more efficiently. To so refine our mass production techniques that we can shave the last penny off the manufacturing cost per unit.

But that's not the *whole answer!*

The same principle must be applied to the *manufacture of a sale.* Because that's where business will find its best opportunities for profit — now and in the years to come.

With a buyers' market already in sight, it is time for business to re-examine the whole process of selling and distribution, and to improve the techniques of marketing its goods and services. The job is a tough one. It calls for streamlining, for more *mechanization* —which is simply another name for more aggressive and efficient advertising.

Skillfully employed, advertising is to selling what the assembly line is to production. It is a machine that increases the capacity of the sales force by the hundreds, or thousands, or by any quantity your market requires—exploring the field, arousing interest, creating a preference for your company and its products.

And nowhere does this machine operate at *higher efficiency* than in the business press, where it is concentrated among your best prospects—and no one else!

What are the ten ways to measure the results of your business paper advertising? You'll find the answers in a recent ABP folder, which we'll be glad to send you on request. Also, if you'd like reprints of this advertisement (or the entire series) to show to others in your organization, you may have them for the asking.

Water and Sewage Works

is one of the 129 members of The Associated Business Papers, whose chief purpose is to maintain the highest standards of editorial helpfulness—for the benefit of reader and advertiser alike.

from across the nation the employees of James B. Clow & Sons send

Seasons Greetings

and wish their customers a prosperous New Year

Yes, the year 1949 should mean prosperity for all of us. For the first time since the war, the Clow organization can now anticipate filling your orders more promptly . . . and meeting all shipping dates as promised. With this in mind, let us plan to go forward together and do our share to meet the huge postwar expansion program for bringing better living conditions to all people.

JAMES B. CLOW & SONS CHICAGO

CAST IRON

and their National Cast Iron Pipe Division, Birmingham, Ala.; subsidiaries Eddy Valve Co., Waterford, N. Y.; Iowa Valve Co., Oskaloosa, Ia.

"DOMESTIC"

PLUNGER SLUDGE PUMP

DESIGNED AND BUILT FOR THE EFFICIENT PUMPING OF PRIMARY SEWAGE SLUDGE

OUR 44 years of engineering and manufacturing experience assure superior construction and service.

DOMESTIC plunger sludge pumps are today performing herculean tasks in every state in the Union, many after decades of gruelling use.

Types Available: 6"—8½"—10"—and 12¼" in single, duplex and triplex types.

Capacities from 35 G. P. M. to 375 G. P. M. at heads up to 115 feet.

All sizes 5½" stroke, adjustable eccentric type.

Furnished with gear head motor and roller chain drive or constant speed motor and V belt drive.

For complete details write to Dept. W.

"If it's a job for a Pump—it's a job for Domestic"

"DOMESTIC"
ENGINE & PUMP COMPANY
A DIVISION OF EMPIRE INDUSTRIES, INC.
SHIPPENSBURG, PA., U. S. A.

Top Performance

. . . AND LONG LIFE DURABILITY

It always takes a lot of planning, changing and testing to perfect any kind of mechanical equipment. Layne Well Water Systems are no exception to that rule, but for over sixty-five years Layne engineers have been doing a lot of brow knitting over in the back shop,—and they are still at it, striving to make further improvements.

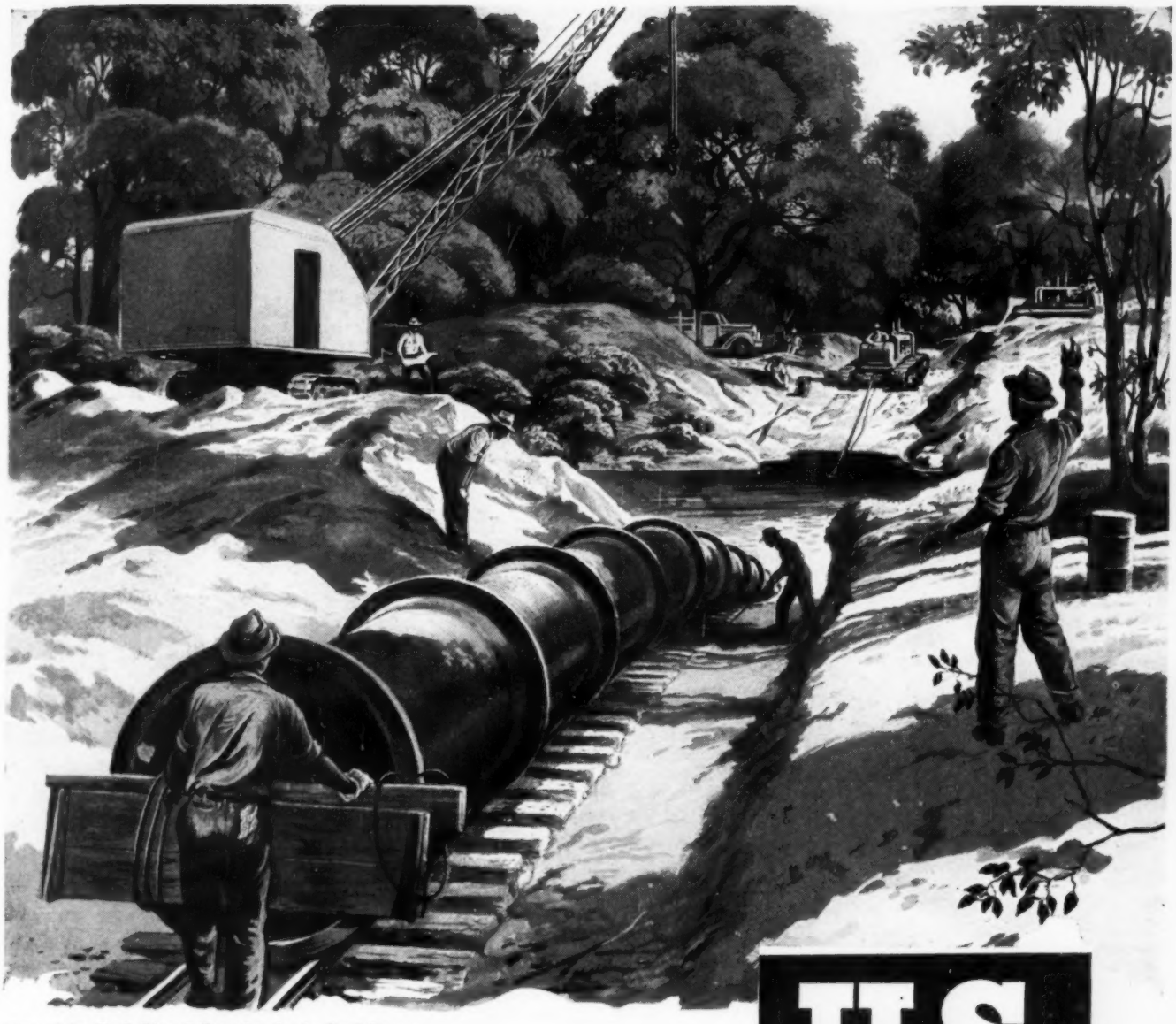
But one thing is certain—very certain! Your Layne Well Water System of today is definitely the finest ever built,—more scientifically designed, more skillfully built, much tougher where wear is the hardest and heavier where the strains are greatest.

The results are, that your Layne Well Water System has a higher peak of overall efficiency, more built in quality and more years of dependable durability. They produce tremendous quantities of water at the very lowest operating cost and put an end to worry about replacement cost for years and years to come. A good many hundreds of installations stand ready to prove the above claims.

For further information about Layne Well Water Systems or Vertical Turbine Pumps, request catalogs, bulletins, etc. No obligation. LAYNE & BOWLER, INC., General Offices, MEMPHIS 8, TENN.

LAYNE
WELL WATER SYSTEMS

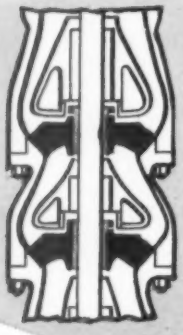
AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc. Seattle, Washington ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Minnesota Co., Minneapolis, Minnesota ★ International Water Corporation, Pittsburgh, Pa. ★ International Water Supply, Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.



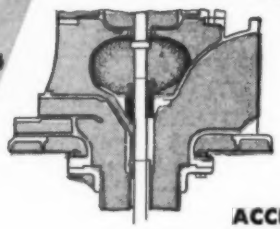
Painted for U. S. Pipe & Foundry Co. by Paul Laune

U.S. PIPE

In the files of our Engineering Service Department that go back nearly half a century, are records of the solutions to unusual problems in pipe design and installation, such as the flexible joint stream crossing illustrated above. If you have such a problem we may be able to tell how a **similar** problem was previously solved. Our wide design and manufacturing experience with special fittings to meet unusual requirements, where standard material cannot be used, may also be found of value to you. **United States Pipe and Foundry Co., General Offices: Burlington, New Jersey. Plants and Sales Offices Throughout U. S. A.**



OPEN IMPELLERS . . . that eliminate overloading, sand-locking and costly stoppages . . . minimize wear . . . eliminate the need for sealing or wearing rings.

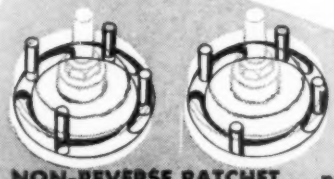


ACCESSIBLE PACKING BOX . . . located at the surface where it is easily inspected, tightened or repacked.

You Get More than Performance with POMONA!

Almost any good pump will give you performance . . . *at the start.* But Pomona Vertical Turbine Pumps give you *sustained* performance . . . consistent efficiency for years *plus* the fundamental simplicity of design that adds up to lowest operating and maintenance costs. Here's why!

ADJUSTABLE FOR CAPACITY AND WEAR. With a simple "at the surface" adjustment, capacity can be varied over a wide range without throttling. Adjustment can also be used to compensate for wear to retain peak efficiency for life.



NON-REVERSE RATCHET . . . prevents pump and motor from rotating backwards . . . eliminates possible damage to pump from accidental power reversal . . . reduces wear and maintenance.

PLUS *true* water lubrication and many other important advantages your Fairbanks-Morse Pomona dealer or branch pump engineer will be glad to demonstrate.

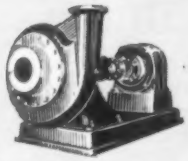
Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

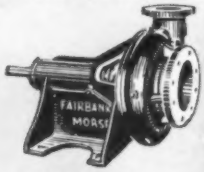
A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

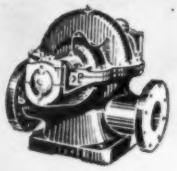
A FEW OF THE COMPLETE LINE OF FAIRBANKS-MORSE PUMPS



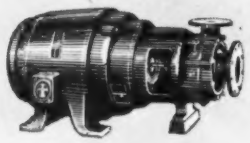
Trash Pumps



Side-Suction



Centrifugals



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CHEMICAL USERS' GUIDE To General Chemical Products for Treatment of Water, Sewage, and Industrial Wastes

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTH (MIN.)	SHIPPING CONTAINERS	APPLICATIONS
Aluminum Sulfate $Al_2(SO_4)_3 \cdot 14H_2O$ approx. *(Filter Alum)*	Commercial & Iron Free: Lump • Ground Powdered	17.25% Al_2O_3	Bags Barrels • Drums Bulk Carloads	Coagulant for water and sewage. Dewatering conditioner for sewage sludge. 1% Sol. pH 3.4.
Aqua Ammonia NH_4OH plus Water *(Ammonia Water)*	Colorless Liquid	26° Be. (29.4% NH_3)	Steel Drums Carboys	Used with chlorine to form chloramines for water disinfection.
Ammonium Aluminum Sulfate $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ *(Ammonia Alum) (Crystal Alum)*	Lump Nut Granular Powdered	11.2% Al_2O_3	Bags Fibre Drums	Coagulant for water. Advantageous for pressure filters. Supplies ammonia for chloramine formation. 1% Sol. pH 3.5.
Sodium Bisulfite, Anhydrous $Na_2S_2O_5$ *(ABS) (Sodium Metabisulfite)*	Powdered	97.5% $Na_2S_2O_5$ (Equiv. 65.5% SO_2)	Fibre Drums	Antichlor. Remove iron and manganese deposits from filter sand. 1% Sol. pH 4.6.
Sodium Silicate $Na_2O \cdot X(SiO_2)$ plus H_2O *(Water Glass) (Silicate of Soda)*	Viscous Liquid	38° to 52° Be. Various Ratios of Na_2O:SiO_2	Drums Tank Cars Tank Trucks	1. Aid in floc formation. 2. Prevent red water corrosion in distribution lines. 1% Sol. pH 12.7
Sodium Thiosulfate $Na_2S_2O_3 \cdot 5H_2O$ *(Hypo) (Sodium Hyposulfite)*	Crystals: Prismatic Rice Selected Universal Granular	99.75% $Na_2S_2O_3 \cdot 5H_2O$	Bags Barrels Fibre Drums	Antichlor. Water solution is neutral.
Sulfuric Acid H_2SO_4 plus H_2O *(Oil of Vitriol)*	Corrosive, oily liquid Various strengths	66° Be. (93.19% H_2SO_4)	Bottles Carboys Drums Tank Trucks Tank Cars	1. Reduce pH and alkalinity. 2. Regenerate carbaceous zeolites and ion exchangers. 3. Activate Baylis Silicate.
Potassium Aluminum Sulfate $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$ *(Potash Alum)*	Lump Nut Granular Powdered	10.7% Al_2O_3	Bags Fibre Drums	Coagulant for water. Slow, even rate of solubility desirable for solution pot feeders. 1% Sol. pH 3.52.
Sodium Sulfite, Anhydrous Na_2SO_3 *("Sulfite")*	Granular Powdered	98.5% Na_2SO_3	Bags Fibre Drums	Antichlor, oxygen remover. Weak solutions absorb oxygen readily. 1% Sol. pH 9.8.
Sodium Sulfate, Crystal $Na_2SO_4 \cdot 10H_2O$ *(Glauber's Salt)*	Crystal & Needle Crystal	96% $Na_2SO_4 \cdot 10H_2O$	Barrels Bags Drums	Neutral Solution. Boiler water treatment (maintenance of sulfate-carbonate ratio).
Sodium Sulfate, Anhydrous Na_2SO_4	Powdered	99.5% Na_2SO_4	Bags Barrels	Neutral Solution. Boiler water treatment (sulfate-carbonate ratio)
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	98.5—103% $Na_3PO_4 \cdot 12H_2O$ (Equiv. 19% P_2O_5)	Bags Barrels Fibre Drums	Boiler water treatment. Cleaning compound. 1% Sol. pH 11.8-12.0.
Disodium Phosphate, Crystal $Na_2HPO_4 \cdot 12H_2O$	Crystal	98% $Na_2HPO_4 \cdot 12H_2O$ (Equiv. 19.5% P_2O_5)	Bags Barrels Fibre Drums	Boiler water. (Calcium and magnesium precipitation.) 1% Sol. pH 8.4.
Disodium Phosphate, Anhydrous Na_2HPO_4	Powdered Flake	96% Na_2HPO_4 (Equiv. 48% P_2O_5)	Same	Same as Crystal, but stronger product.
Sodium Fluoride NaF *(Fluoride)*	Powdered (white or blue colored: Nile Blue) Light or dense	90% and 95% NaF	Bags Barrels Fibre Drums	Fluorination of water supplies. (For information, consult with local health officers.)

FOR THE LABORATORY: Baker & Adamson Laboratory Reagents

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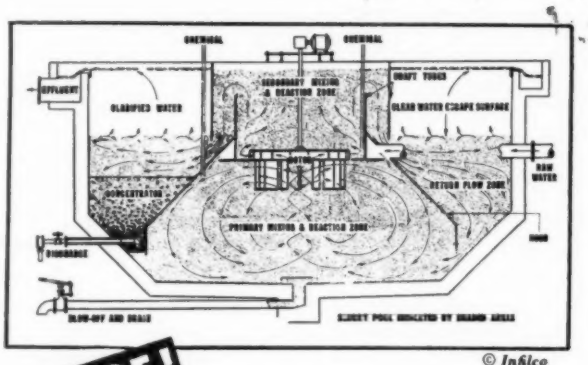

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70%	of water pumped.....	3 mos. 22 days	NO PAY
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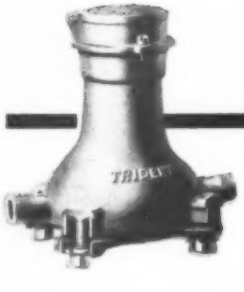

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WATER & SEWAGE WORKS

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DEVELOPMENTS IN THE WATER WORKS FIELD DURING 1948

by

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NEW YORK UNIVERSITY
NEW YORK, N. Y.

WATER resources have been one of the principal points of interest of the water works industry during the past year. Severe droughts, expanding populations, and new industries have taxed the capacities of many of the public water supplies of this country. In recognition of the significance of the many problems allied with water resources, the American Water Works Assn. has established a new Water Resources Division which has now taken its place as one of the three principal divisions of the Association.

The Author

Surface Water Supplies

The meaning of the term "safe yield" has been emphasized by the prolonged dry spells during 1948. Perhaps the most alarming situation was that at San Diego, Calif., where the six reservoirs of the city had a combined safe yield of 30 mgd., while the total demand during the past year was approximately 55 mgd. This represented an increase in the demand for water of more than 100 per cent since 1940. The city has even resorted to the seeding of clouds with dry ice to induce precipitation.

During 1948, in the midst of one of the most severe droughts in the history of that part of the country, when the reservoirs were being depleted by the high demand for water, the Colorado Aqueduct was completed and made available for the supply of 55 mgd. from the facilities of the Metropolitan Water District of Southern California. This supply has now assured San Diego of a safe yield of 85 mgd. for the ever expanding population of that community.

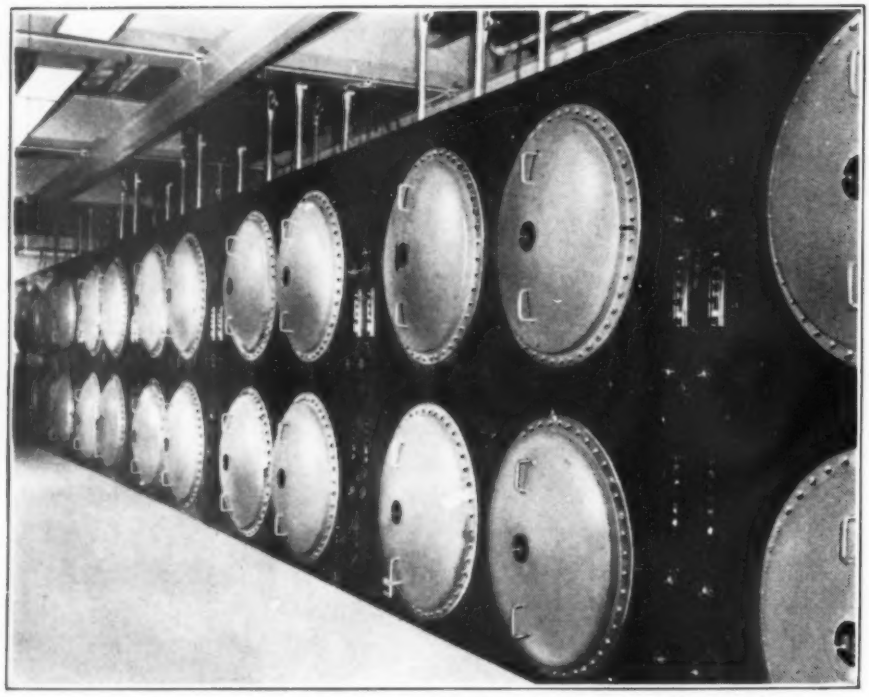
New York City has been faced with similar problems. During 1948 the average demand was 1,170 mgd., whereas the safe yield of the various sources of water supply was 1,045 mgd. Construction of three large reservoirs which will supply water to the Delaware Aqueduct will provide an additional 540 mgd. when the entire project is completed in 1956. Some ground water supplies are deteriorating and it is estimated that in 1956 the total safe yield of the supply will be 1,400 mgd. It is estimated that the demand in 1956, however, will be up to 1,600 mgd. Thus, even a considerable program of construction, which has been in the planning and initial stages of investigation since 1928, will not provide enough water on the basis of safe yield during dry periods. To meet this situation, the Board of Water Supply of the City of New York is undertaking studies for emergency supplies to augment the present sources, and is also preparing to investigate additional sources of supply to meet the future requirements. Furthermore, a program of metering is also being initiated to decrease the total demand.

The year 1948 has witnessed the greatest progress since the inception of the Delaware project in that Merriman Dam has been completed to its maximum height and should be ready during the latter part of 1949 to impound water in the reservoir, which will furnish 100 mgd. on the safe yield basis.

Many other cities have faced similar situations with their water resources. Cleveland, Ohio, with the whole of Lake Erie at its front door, was faced with the threat of lack of water during the summer of 1948. With a maximum pumping capacity of 315 mgd., peak daily demands of 331 mgd. were experienced. The excess had to come from water stored in city reservoirs. During 1948 progress was made on the construction of a new intake and reservoir, part of the Nottingham Project to furnish an additional 100 mgd.

Columbus, Ohio, initiated work on the Big Walnut Creek Project during the past year to provide an additional safe yield of 43.5 mgd. The present safe yield is 51.3 mgd. while peak daily pumpages of 56 mgd. have been experienced.

Two cities in Michigan completed a construction program to provide a new source of surface water to replace waters of excessive magnesium and industrial waste content. The Sag-



Installation of Bank of Ozonators in Philadelphia's Belmont Filtration Plant
(Total capacity of ozonators is 1250 lb. per day sufficient to treat 36 mgd.)

inaw-Midland Water Supply Commission was organized to provide 23 mgd. to Saginaw, and 20 mgd. to Midland, by means of an intake from Lake Huron, pumping stations, reservoirs, and 80 miles of 48-in. prestressed reinforced concrete pipe.

Ground Water Resources

Equally serious situations have arisen in communities relying upon ground water resources. Conditions in Florida typify the difficulties encountered. Floods, droughts, overdrainage of the land, topography, geology, and salt water encroachment have all contributed to the instability and shortages of water supplies from ground water sources. Work was begun during 1948 to obtain fairly complete information on surface and subsurface conditions for the entire state. Topographic and soil suitability maps are necessary, together with streamflow rainfall, evaporation and transportation records. Complete subsurface information on the reservoir capacity, the rate and directions of the flow in the aquifers, and the location and extent of the areas and rate of recharge are also essential. Population and economic development studies, together with present and future water requirements, as well as estimates of the annual damage from flood and drought, are to be made before the entire picture can be evaluated on an economic basis and plans made for remedial measures.

Conservation and control of water resources have also been emphasized in Texas during the past year. Many Texas towns have now outgrown their present sources of water supply and are endeavoring to develop new water sources of proper quality for municipal, industrial, and irrigation purposes through the formation of river authorities or water districts, which have been authorized by state legislative enactments.

Within the past six years industrial plants costing more than $1,500,000,000 have been erected in Texas. Water demands are rising at a rapid rate and the unregulated flow of Texas rivers is failing to meet these demands during drought periods. In some areas limited ground water supplies also are unable to meet these increasing demands, and the withdrawal of ground water is beginning to lower the water table at an excessive rate. In the Texas City-Galveston area, the artesian head has declined more than 100 feet since 1933, following an increase of more than 300 percent in the pumpage for public and industrial supplies. This decline has been attended by increased salinity of the ground water in parts of the area. Cooperative plans are being developed toward the ultimate solution of this regional problem by bringing in surface water from the San Jacinto or Brazos Rivers to supplement the failing supply of ground water.

The ultimate solution to the entire problem in the State of Texas depends upon the development of surface water supplies by impounding the flood flows of Texas Rivers in reservoirs and making that water available for beneficial use. Ground water must be utilized only to the extent that each underground reservoir will supply water of good quality at an economical rate for an indefinite period of time.

Recharge of Ground Water

Illinois has also been experiencing a receding ground water table which has caused industrial and municipal engineers to concentrate their activities on the development of new sources of water. The most interesting experiment undertaken during the past year has been that at Peoria. This city has been pumping from the Peoria-Pekin ground water pool which lies beneath the Illinois River, but pool is not fed by it. In the past five years the water table has dropped approximately 17 feet to a level which has created a crisis. The only other immediate source is the Illinois River, the use of which, however, would require expensive construction for an adequate treatment plant. In lieu of this, recharge of the underground reservoir has been undertaken by pumping river water into it through new shafts, filled with sand and gravel to permit access through this material to the underground reservoir. Thus, the pool beneath the river will be replenished and the water will undergo extensive filtration in penetrating the sands before reaching the pool. This development may offer a solution to a number of other cities.

Recharge of ground water basins has been suggested in California during the past year when the severe drought caused alarm. The material for recharge would not be surface water supplies, but reclaimed sewage. In suggesting this, Rawn stressed that water reclamation should be completely divorced from the sewage treatment plant and considered as an independent operation so that treated water could be leached into the underground water tables at such times as desired.

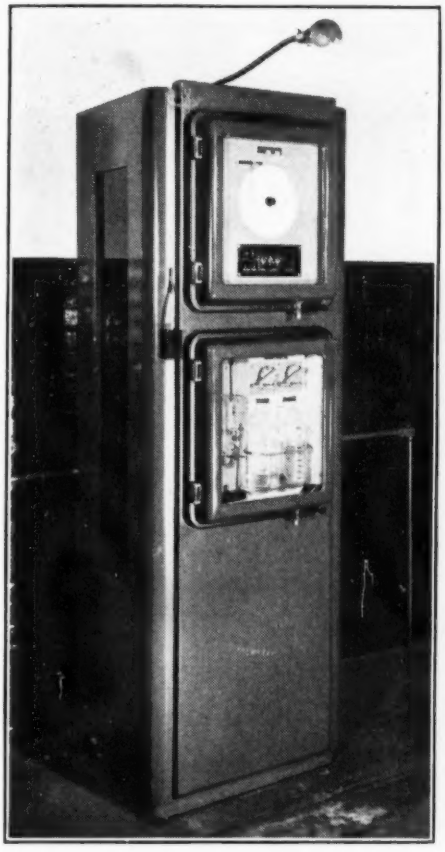
The need for this recharge is emphasized by the fact that the west basin area of Los Angeles County has an existing water table which during 1948 was 75 feet below sea level. The salt water has already advanced underground almost two miles inland from the coast at El Segundo. This salt front is encroaching at the rate of 500 to 1,000 feet per year causing many new wells to be drilled to replace old wells in the salt area.

Chlorination

Although chlorine has been advantageously used as a disinfectant for water supplies during the past 40 years, science has only recently begun to reveal the fundamental chemistry and biology of its disinfecting action. At the symposium on water chlorination at Atlantic City, Fair outlined the chemistry and biology of chlorine reactions in water, including a mathmatical evaluation of disinfection efficiency. Data were presented to show that minute quantities of HOCl were effective in killing coliform organisms. (e.g. concentration of 0.005 ppm. of HOCl would achieve a 99 percent kill of Esch. coli in 30 minutes at 2° to 5° C.) The OCl^- ion possesses about 1 percent of the disinfecting efficiency of HOCl in performing the same kill in the range of pH from 5 to 12. At pH values from 5 to 8.5 practically the whole disinfecting action is due to HOCl, whereas at a pH of 11, it is chiefly due to OCl^-. Studies were also presented to show the relative effectiveness of chloramines.

Break-point chlorination treatment has been investigated but the complexities of the break-point reactions are so great that considerable additional work must be done before a consistent theoretical treatment can be achieved and the reactions completely understood. Free residual chlorination is being used extensively throughout the country. Through 1948 approximately 500 water treatment plants had adopted this method of water treatment involving the so-called break-point reaction to obtain free residual chlorine. The results have shown superior bactericidal action, improvement in taste and odor control, as well as color removal, and the elimination of after-growths in the distribution system.

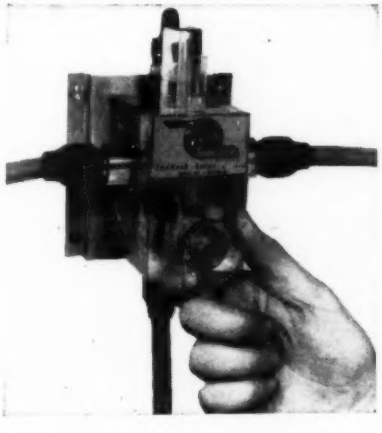
An important instrument for the control of water disinfection was installed in 25 plants throughout the country during 1948. By means of the Chlorine Residual Recorder an accurate record of chlorine residuals is maintained at all hours of the day in the water delivered to the distribution system. This device involves a sampling cell and a recording mechanism. In the cell, the water sample acts as an electrolyte between two electrodes in such a way as to permit the cell to generate a direct current proportional to the chlorine residual. One reagent pump feeds a buffer solution to the sample to eliminate possible recording errors due to variations in the pH of the water. Another pump is used to feed potassium iodide when it is desired to record total chlorine residual instead of only free available chlorine residual. The advantages derived from the use of this mechanism have been to provide the operator with an instantaneous check on his chlorination results and to secure better chlorination control at all hours of the day without requiring frequent tests on the part of the operators.



W & T New Residual Chlorine Recorder
(First installation at New Milford plant of Hackensack Water Co.)

Chlorine Dioxide

Disinfection of water by means of chlorine dioxide has also been subject to considerable fundamental investigation during the past year. Studies have shown that the reactivity of chlorine dioxide with organic materials is not greater and is usually less than the reactivity of chlorine with the same substances. Chlorine reacts readily with ammonia, while chlorine dioxide does not. This indicates that the chlorine dioxide demand of surface waters containing small amounts of organic pollution will be less than the chlorine demand. Field tests have shown that natural waters exhibit very little variation in chlorine dioxide demand. Tests have been developed for the determination of chlorine dioxide residual and for the control of this method of treatment in the disinfection of water.



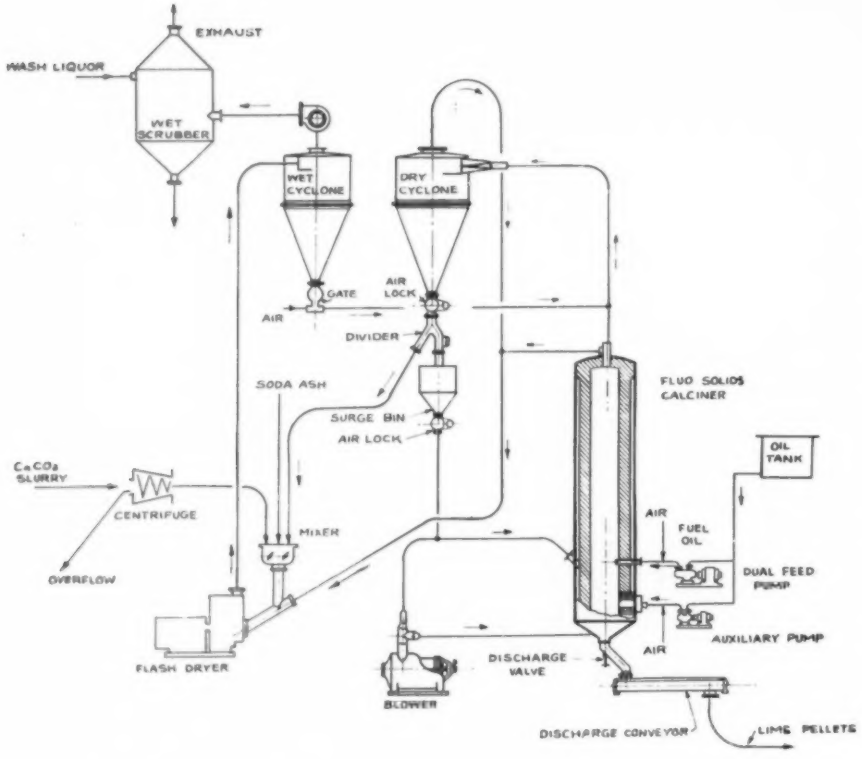
Paddock's Sureclor Automatic Water Chlorinating Unit

Ozonation

Ozonation has taken a great step forward during the past year with the completion of the installation of the ozone plant at the Belmont Filtration Plant of the City of Philadelphia. The accompanying photograph shows the ozonators, together with their control valves and electrical control devices. The total capacity of these ozonators is 1250 pounds per day, sufficient to treat 36 mgd. with 1 to 2 ppm. of ozone. The specific problem for which this plant was designed was the oxidation of taste and odor producing compounds in the water from the Schuylkill River which is one of the major sources of supply in the City of Philadelphia. This river receives many types of industrial wastes and is subject to heavy algae growths. When the water is chlorinated many objectionable tastes and odors are produced. Experiments have already shown that ozonation will reduce these tastes and odors to tolerable limits by the destruction of phenol and other objectionable organic compounds. Chlorination will be utilized for final disinfection after filtration of the water supply.

Fluoridation

Supplementing water supplies with fluoride has been accepted by a number of municipalities during 1948. The officials of Madison, Wis., conducted a survey among dentists and doctors to determine whether they would sanction the addition of fluorides to the water supply in the city of Madison. The replies were startling in that 103 out of 106 dentists and 154 out of 180 medical doctors asked the Common Council to direct the water department to add about 1 ppm. of hydrofluoric acid for the benefit of the consumers. The addition of fluoride to the water was considered as a supplementation of the diet and not as medication.



Dorr Fluosolids System Pilot Plant for Calcining Lime Sludge at Lansing, Mich.

Water Conditioning

The large Chicago Filtration Plant has been operating successfully and the results have been reported for its first year of operation. One of the most interesting developments in connection with the operation of this plant is the application of modern methods of physical and chemical analysis to the control of water treatment processes. The electron microscope is being applied to water works research in Chicago to attempt to find better methods for the identification of bacteria and for the control of the quality of water. By means of this microscope, bacteria may be magnified 50,000 times and solids may be magnified 200,000 times. Another apparatus which is worthy of note is the flame spectrophotometer. With this instrument, it is possible to make a rapid mineral analysis of water. Magnesium and calcium determinations can be made at the rate of 4 samples per minute with an accuracy of 0.1 per cent.

Electrolytic methods of producing aluminum hydroxide and hydrous aluminum oxide flocs have made considerable strides during the past year. At Lawrence, Kan., the process was placed in operation in a full scale plant during 1948. It is claimed for these methods that 100 pounds of aluminum plate will produce as much aluminum oxide floc as approximately one ton of commercial alum. The electrolytic cells consist of pairs of aluminum and stainless steel plates, with a low voltage impressed across the cells to release aluminum ions to the water passing by the plates. One of the important advantages of this process is the reduction in the handling of chemicals and the space needed for the storage of these chemicals. Results of the operation at Lawrence, Kans., will be awaited with interest, in order that the applicability of the process to other treatment plants may be determined on a sound economical basis.

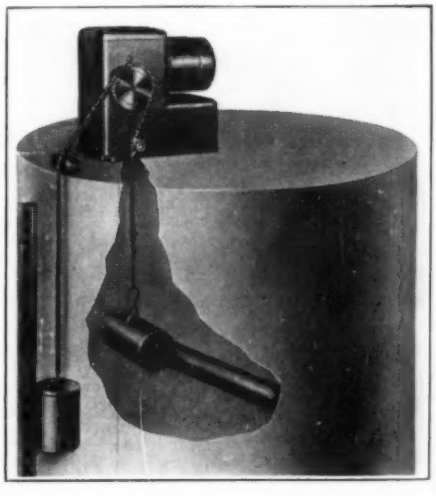
The Committee on Capacity and Loadings of Water Treatment Processes of the Water Purification Division of the A.W.W.A. conducted a survey of the industrial and municipal treatment plants which utilized solid-contact process basins. Most of these units are utilized for water softening purposes and have been successful in reducing the time required for coagulation and sedimentation and the size of units necessary for treatment of given quantities of water. Resulting economies in construction have been welcomed in these times of rising costs.

Water Softening

The development of synthetic detergents and their rapid increase in use since the end of the war has made it necessary to reconsider the significance of water softening from the economic standpoint. Since these synthetic detergents are as effective in hard as in soft water, no savings can be anticipated by softening water when these detergents are used. The soap industry expects that eventually the annual consumption of synthetic detergent mixtures will approach 5 billion pounds yearly. Much of this will be utilized for industrial purposes. It is estimated that approximately 50 percent of the soap consumption, which in 1946 amounted to 2.32 billion pounds, will be replaced by synthetic detergents in the not too distant future, particularly true in the hard water areas where these detergents have proven of such remarkable value in household use.

Therefore, it behooves the water works profession to evaluate the significance of these detergents in studying the economics of water softening for municipal uses. Greater emphasis must be placed upon the annual per capita expenditures attributable to the deterioration of domestic plumbing, the scaling of heating and cooking apparatus and other economic problems arising from the use of hard water for domestic and industrial purposes. Justification for the construction of municipal water softening plants based upon soap savings alone, may rightfully be questioned by taxpayers and civic groups.

The phenomenal growth in the number of separate household softening installations in the past few years is another development which demands the attention of the water works industry. In this country there are more than 400,000 individually owned zeolite home softeners and approximately 400,000 additional units installed and owned by operating companies. These companies install zeolite softeners in private residences and furnish a recharging service with frequency based upon use and water hardness.



Liquid Conditioning Co. Chemical Feeding Device

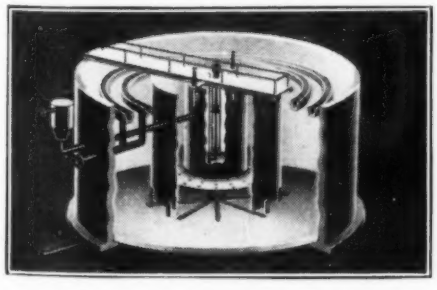
Installation charges average $8.00 per unit while monthly service charges range from $2.40 to $5.40, depending on frequency of recharge.

The question to be decided by the water works profession is whether it might not be more economical to soften the entire municipal supply at a central plant so that the entire population might benefit. The cost figures for home softeners might well be utilized in economic studies leading to a public relations program to sell the idea of softening to the community.

Considerable emphasis has been placed during the past year on the reclamation of lime from water softening sludge. During 1948 the City of Miami, Fla., completed a lime reclamation plant capable of producing 80 tons of CaO per day. Concentration of settling tank sludges is accomplished in thickeners, followed by centrifuges. A rotary kiln is used to dry and calcine the centrifuged sludge. The heat required for calcining is 8,500,000 Btu. per ton of lime produced and is provided by oil burners.

The cost of the Miami calcining plant was $550,000. It is expected that the savings in chemical costs will pay off this investment in 6 to 7 years. Since lime formerly was purchased in Tennessee, Missouri and Arkansas, the freight charges frequently equaled the original cost of lime. An average of 54 tons of CaO are required daily in softening Miami water. This will leave an excess of lime produced in the calcining process so that approximately 8,000 tons should be available for sale to other communities in the next 6 or 7 years to further reduce net cost of operation of softening plant.

During the past year the water Board of Lansing, Mich., has been operating a pilot plant for the calcining of lime sludge by the Fluosolids System. After thickening, centrifuging, and flash-drying, the sludge is introduced into a vertical calciner in which lime reburning takes place in a fluid suspension. Particles of CaO are pelletized to make them readily available for feeding to lime slakers and to minimize dust conditions. The accompanying diagram shows the Fluosolids calciner. Heretofore, the rotary kiln process was not considered economical below capacities of 25 tons of CaO per day but the Fluosolids System will permit economical operation at design rates as low as 6 tons per day, with fuel consumption averaging 7,500,000 Btu. per ton of CaO produced. This system is also adaptable to larger installations with greater economies of operation.



Walker Process Equipment Clariflocculator

The Old and the New

(New 50,000 gal. Chicago Bridge and Iron ellipsoidal bottom elevated water tank at Braidwood, Ill.—Old wooden tank at left.)

Minneapolis has a new recarbonation plant which utilizes pure carbon dioxide instead of flue gas. The installation cost of a plant of this type is approximately one-third of that for the conventional oil- or gas-burning unit. The gas is fed from liquid storage tanks through vaporizers and meters into the water which absorbs 98 percent of the pure gas (flue gas is only 12 to 15 per cent). Present costs of pure CO_2 are slightly higher than the cost of production of flue gas.

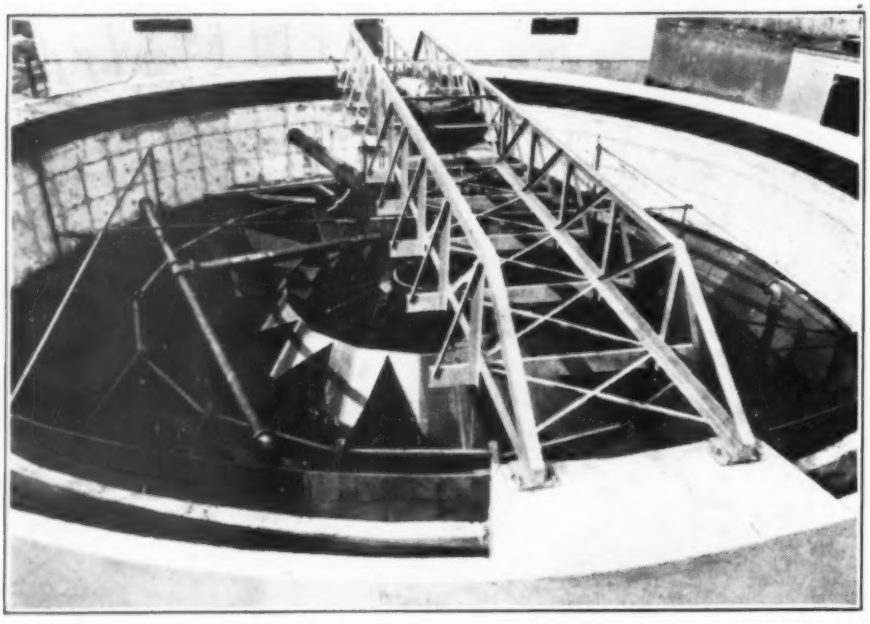
Industrial Water Treatment

Railroad locomotives have long utilized internal treatment of water. Water treatment plants along the route have provided waters which could be further treated within the boilers. With the advent of the diesel locomotive, the water situation has changed radically. Cooling systems and train heating boilers on diesel locomotives require water very low in solids content. A number of railroads have resorted to deionization or distillation plants to produce water for the exclusive use of the diesels.

A novel method has been developed for the removal of silica from an industrial water supply containing up to 200 ppm. of SiO_2. This involves the rusting of cast iron shavings in the presence of water and air to produce a colloidal precipitate of ferric oxide which has a high adsorptive capacity for silica. In order to present fresh iron surfaces to produce rust, the iron shavings are placed in a rotating 55 gallon oil drum into which air was blown. This unit was capable of producing a high enough concentration of ferric oxide to remove 200 ppm. of silica.

Distribution Systems

Expansion and strengthening of water distribution systems has been one of the important construction activities of municipal governments and



Liquid Conditioning Co. Liquon Sludge Contact Reactor Internal Construction—5 mgd. Capacity

water utilities during 1948. The situation which confronts so many cities as a result of wartime increase in population and curtailment of municipal construction work is typified by the City of Los Angeles. From 1940 to 1948 water demand increased from 227 to 334 mgd., an increase of 52 percent. During 1947, Colorado River water from the feeder trunk of the Metropolitan Water District of Southern California was made available to the extent of 8 mgd. Increasing quantities of this latter supply will be needed to care for the city which continues to experience rapid growth. Work has been initiated during the past year on the construction of new trunk lines and reservoirs in the central section of the city in order to be able to distribute an eventual 258 mgd. of Colorado River water in addition to over 300 mgd. from other sources.

Los Angeles is contemplating reinforcing its distribution system with large diameter steel mains lined with coal tar coatings and with cement. Experience and tests have indicated a life expectancy of approximately 100 years for these steel mains when properly coated and lined.

A worthwhile contribution to the literature on distribution systems was the article by Barnard (*Jour. A.W.W.A.*, Jan. 1948). Design standards for steel pipe were presented to include in convenient form both hydraulic and structural data for the design of steel pipes, mechanical couplings of the Dresser and Victaulic types, fittings, expansion joints, saddles and other information of value to the designing engineer and water works superintendent.

Another significant contribution on distribution system characteristics, was the symposium on sulfur jointing compounds presented at the Atlantic City Conference of the A.W.W.A. in 1948. Water superintendents, research workers, and manufacturers recited their experiences with these compounds on cast iron water mains.

Some cities have experienced joint failures, graphitization of pipes, and loss of sulfur while others have had excellent results. No definite conclusions could be reached with the exception that the oxidation of sulfur can be controlled by blending with the sulfur 500 ppm. of sodium pentachlorophenate, a successful bactericidal agent for the control of the organisms responsible for the oxidization of sulfur to sulfates.

The disinfection of water distribution systems has been the subject of much controversy for many years. In 1948, however, the late Cecil K. Calvert published his conclusions together with a report by a special A.W.W.A. committee of which he was chairman. These publications established a procedure for disinfecting water mains. The recommendations must be read in full in order to be able to apply them to specific problems. The need for mature judgment on the part of experienced water works personnel, the variations in results likely under any standard procedure, and the alternative methods which may be applied in special cases were all emphasized in Calvert's report. Selection of packing rings, which may be made free from coliform organisms, is outlined so that no excuse should exist for continuation of the use of hemp which has been so troublesome. Many practical suggestions are contained in this report (*J.A.W.W.A.*, Feb. 1948).

Water-Borne Outbreaks

The Atlantic City Conference of the A.W.W.A. presented a symposium on water-borne out-breaks. The statistical summary and analysis of the causes of 327 outbreaks indicated that a total of 111,320 cases were reported from 1938 through 1945. Approximately 100,000 of these were on public water supplies. Many of these cases were attributable to failure of operators of filtration and chlorination plants and approx. 42 percent were caused by cross-connections and back siphonage. When examined in the light of total cases, about 90 percent of which were gastro-intestinal disturbances, the figure looks high, averaging 12,500 cases per year for public water supplies. However, when these results are considered on a statistical basis of probability of occurrence among water consumers, the figure is low.

Consider the 80,000,000 consumers of water from public supplies owned by municipalities or utility corporations. Over the period of one year 29,200,000,000 consumer-days (80,000,000 consumers x 365 days) of water consumption are involved. Only 12,500 consumer-days of water borne infections were experienced in a year. Therefore, the probability of water-borne disease is in the ratio of 12,500 to 29,200,000,000 or 1 chance in about 2,400,000. From the viewpoint of safety in avoiding water-borne diseases, this indicates 99.999 + percent success. The water works industry must continually strive to improve its record of performance but should also survey its past performances and inform the public of the excellence of its safety record.

DDT in Reservoirs

During a polio epidemic in the Wilmington area the city and its environs

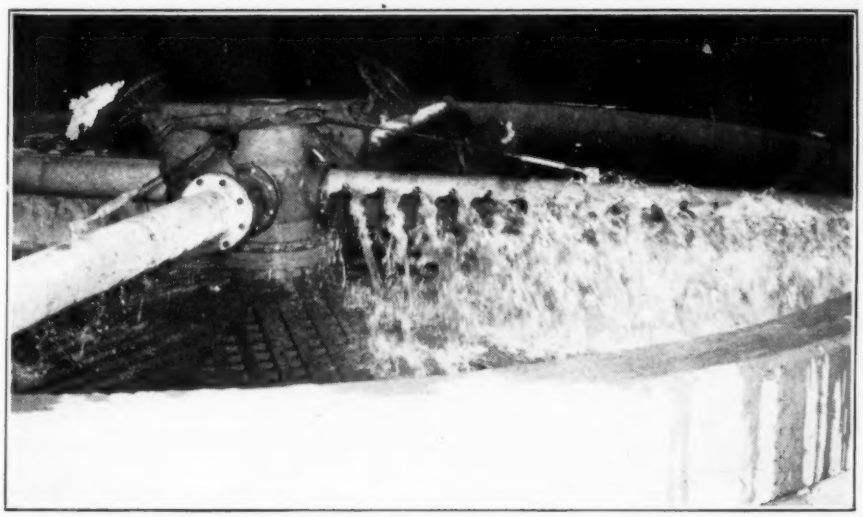
Payne Dean's Powerwrench, the Portable Gate Valve Operator

was sprayed from airplanes with DDT. for the control of insects which might transmit the polio virus. DDT. was collected in one of the city's open storage reservoirs serving the distribution system. Total organism counts in the reservoir usually averaged 50 per ml. during the summer months. After DDT. spraying, however, it was noted that the count of Synedra went up to 10,000 per ml. and the turbidity to 20 ppm. Treatment with normal dosages of copper sulfate and chlorine did not remedy the situation appreciably. It was concluded that the normal mixed population of organisms in the reservoir served to maintain a balance between Synedra and the other organisms. When DDT. was present many of these other organisms, normally antagonistic to Synedra, were killed by the DDT. Synedra, which evidently is not affected by DDT., thrived in its uninhibited environment. The advent of cold weather and the cessation of spraying, together with heavy dosages of chlorine and copper sulfate, eventually brought the condition under control and the normal balance of organisms was restored in the reservoir. Two other reservoirs in the city were located outside the zone of DDT. spraying and did not experience an appreciable change in organism counts during the entire summer. On the basis of the Wilmington experience water works operators should be extremely cautious in the use of DDT. and similar insecticides which may upset the balance of nature.

Cathodic Protection

During 1948 the first report was published on the application of cathodic protection for the prevention of external corrosion in an entire water distribution system. [illegible] Jackson, Texas, a war-built to[illegible] with galvanized steel water mains, showed failures at the connection between the service lines and mains all over the city. The installation of magnesium electrodes near every service connection established cathodic protection of sufficient voltage and amperage to stop corrosion. No further leaks were reported after two years of service.

R. W. Sparling Portable Metrograph to Check Meter Recording



Sidney, Ohio. Contact Degasifier (Aerator) for Water Treatment—Walker Process Equipment Company

Cathodic protection in elevated storage tanks has been very successful when properly applied. In an attempt to simplify the system, an electrodeless device was developed. This consisted of placing "element anodes" at selected points around the periphery of the tank and permitting current to pass through the tank walls to the roof and the base of the tank which were grounded. The method proved to be simple to install and operate and had only one drawback—it did not work.

It remained for Pallo to prove that an electrode-less installation in a wash-water tank at the New Milford Plant of the Hackensack Water Company was a failure. His results were presented at the A.W.W.A. Conference in Atlantic City in 1948. By observations in the tank over an extended period, as well as laboratory experiments on small tanks, Pallo showed that cathodic protection as such did not exist when element electrode-less "anodes" were used. Corrosion was just as severe with this method as when no current was applied to the tank.

On the other hand, Pallo's experiments showed the effectiveness of genuine cathodic protection devices in controlling corrosion on the submerged surface of water tanks. Aluminum anodes, with an external current applied between the anode and the tank wall serving as the cathode, were eminently successful. Magnesium anodes which generated their own potential to iron without externally applied voltage were also successful after an initial lag period.

Air Conditioning

Requirements of water for air conditioning have been the subject of numerous discussions in the water works field during the past year. In some cities distribution systems are taxed beyond capacity in concentrated areas where water requirements are high during the summer months. Bean, of Philadelphia, has estimated that the effect in that city is to increase the peak demand by 4 to 9 percent. If the increase of air conditioning facilities continues at a rapid rate, the use of water for this purpose might well exceed 25 percent of the total demand, unless some stringent controls on the use of water are adopted.

Some water utilities have suggested applying higher rates to water used for air conditioning by furnishing this water through separate meters. Other utilities have welcomed the increased water consumption because it increases their total income. The entire situation seems to be a matter of the availability of water, the capacity of distribution system, the rates charged for water, and the need for conservation within reason on the part of water consumers using air conditioning facilities cooled by water.

One of the outstanding mechanical developments of the past few years has been the Heat Pump. Utilizing a principle somewhat similar to that of the ordinary domestic refrigerator, it is possible to apply this method to air conditioning to conserve water. The cooling of the refrigerant is accomplished by pipes submerged in the ground, preferably in contact with ground water. The extent to which this method of air conditioning can be applied will depend upon the flow of ground water past the submerged coils. In the winter-time the Heat Pump is utilized for extracting heat

Proportioneers Pur-O-Cel Water Purification System for Small Supplies

from ground water, as well as the earth itself, and transmitting this heat to buildings.

Rates

The need for increased water rates has crystallized during the past year to the extent that a number of municipalities and water utilities have already taken action. The subject has been discussed at great length by water works engineers whose opinions seem to be that a revision of rates amounting to approximately 35 percent is required. Public relations programs are very much needed to make the citizens aware of the economics involved in the operation of a water utility and to carry out a program of instruction so that rate increases can be obtained without too strenuous an opposition.

Stream Pollution

Stream pollution control activities were highlighted during 1948 by the passage of Public Law 845, the Federal Water Pollution Control Act. This act states in part that "it is the basic policy of Congress to recognize, preserve and protect the primary responsibilities and rights of the states in controlling water pollution, to support and aid technical research to devise and perfect methods of treatment of industrial wastes which are not susceptible to known effective methods of treatment, and to provide federal technical services to state and interstate agencies and to industries, and financial aid to state and interstate agencies and to municipalities, in the formulation and execution of their stream pollution abatement programs."

The U. S. Public Health Service and the Bureau of Community Facilities of the Federal Works Agency will act jointly under the provisions of this act.

Fourteen major river basin offices are contemplated and will serve as the operating centers for the U.S.P.H.S. to cooperate with municipalities, industries, state and interstate agencies. Technical personnel at these offices will have the support of the research and technical facilities of the Public Health Service Laboratory in Cincinnati where a large new laboratory will be constructed.

The Ohio River Valley Sanitation Compact was also signed during 1948 by the states of New York, Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, and Illinois. These states have pledged to enact any necessary legislation to enable each such state to place and maintain the waters comprising the Ohio River Basin in a satisfactory sanitary condition. The objectives are to make these waters available for safe and satisfactory use for public and industrial water supplies after reasonable treatment and adaptable to such other uses as may be deemed legitimate.

National Research Council

The water works profession finds representation in this important policy-forming agency through the Committee on Sanitary Engineering and Environment of the Division of Medical Science. One of the important activities of this committee during the past year has been the formulation of policies pertaining to the sanitary engineering aspects of major catastrophies. The committee recommended to the National Research Council that a permanent sanitary engineering unit be organized in the U. S. Public Health Service to carry out disaster and national security activities. The duties of this unit would be to coordinate the sanitary engineering work of federal, state and local agencies, with special emphasis on the mitigation of hazards to civilians in times of peace and war.

The various features involved in the development of the atomic bomb and other activities associated with the production of radioactive substances and the use of nuclear energy were particularly stressed. Research is being undertaken by a number of federal agencies, as well as academic institutions and private research organizations to determine the effect of radioactive substances on water supplies and the control of the discharge of these substances.

One of the imperative needs of the moment is the training of sanitary engineers to become familiar with nuclear physics and its application to the problems of sanitary engineering. Through the Committee on Sanitary Engineering and Environment, the National Research Council has emphasized to the various governmental agencies concerned with atomic energy the services which the sanitary engineering profession is qualified to render in the solution of the many new and perplexing problems associated with the development of the fundamental sciences.

A.W.W.A. Activities

One of the most interesting programs of the A.W.W.A. has recently been completed. In a series of eight brochures, a program of public relations activities designed to publicize the significance of water departments and their accomplishments has been outlined and distributed to members

Northrup & Co. Rubber Packing Gasket for Bell and Spigot Joint Caulking

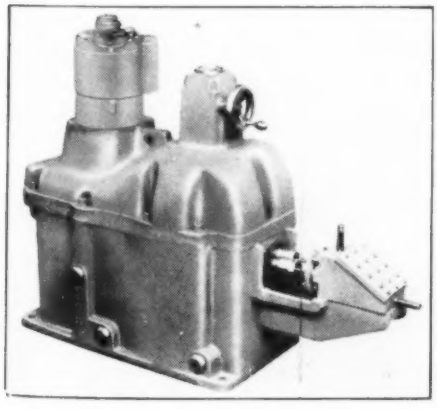
of the Association. If properly carried out in accordance with the many helpful suggestions presented in the program, water works men cannot help but stimulate consumer interest and generate pride among consumers in the "silent service" rendered by the thousands of faithful workers in this huge industry. The Association has led the way; now it is up to the individual members to "carry the ball," and put the program across in each community. "Willing Water" should find many new friends throughout the country if this program is prosecuted to the fullest extent.

As mentioned earlier in this article, the creation of the Water Resources Division was a major development in the A.W.W.A. during 1948. In addition, the activities of the National Water Policy Committee were crystallized in the adoption by the Directors of the A.W.W.A. of a National Water Policy.

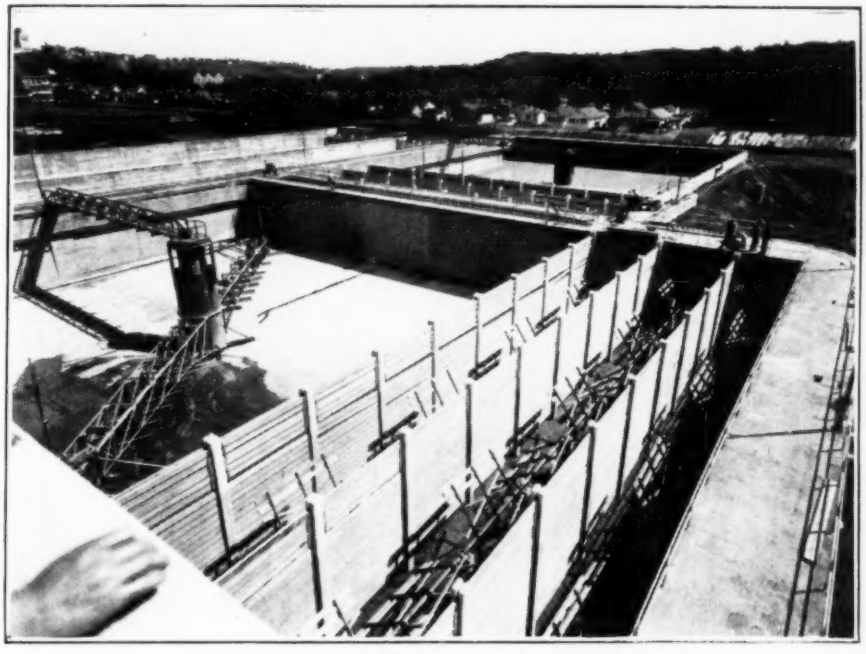
This policy represents the position of the Association on the controversial issues involved as the various interests contest for valuable water resources. Foremost among the provisions of this policy is the establishment of first priority for the development of water resources for beneficial consumptive use, both present and future, of water for domestic and municipal purposes. A plea was also made for the preparation of plans for the unified regulation and development of the river systems of the country upon sound engineering and economic principles.

Construction Activities

Construction of water works facilities has increased in volume each year since the end of the war. Costs of construction continue to rise with no apparent degree of stability yet in sight. The Engineering News-Record's dollar volume of water works contracts awarded in the past five years, together with the ENR Construction Cost Index for each of these years, are tabulated below. Values for the entire year of 1948 include a projected estimate for the latter weeks of the year.



Milton Roy "Constametric" Pump for Chemical Feeding



New Water Purification Plant in Edmonton, Alberta

(A lime-soda softening plant utilizing Dorrco Flocculators and Squarex Clarifiers.)

Year	$ Volume	ENR Construction Cost Index 1913=100
1944	$ 33,304,000	298.72
1945	61,039,000	307.75
1946	109,159,000	346.04
1947	139,141,000	413.16
1948	191,648,000	460.77

Although large in dollar volume, the total expenditures during 1948 do not begin to approach the amount which should be expended to fulfill the present needs of the water works industry. During the past year the U. S. Public Health Service published an inventory of nation-wide water supply needs based on an ENR Index of 348 which prevailed at the time the survey was initiated. The survey shows that a total expenditure of $2,268,982,000 is called for to provide adequate public water supply systems throughout the country. It is estimated that approximately 48 percent of this sum should be expended for distribution systems, 34 percent for new or increased sources of supply, 16 percent for treatment works and 2 percent for miscellaneous purposes. On the basis of the present ENR Index, these projects would cost approximately three billion dollars.

Much has been accomplished in the water works field during the past year but a great deal more lies ahead to challenge the ingenuity and resourcefulness of all who are allied in this multi-billion dollar industry on which so many millions of Americans depend for their health and welfare.

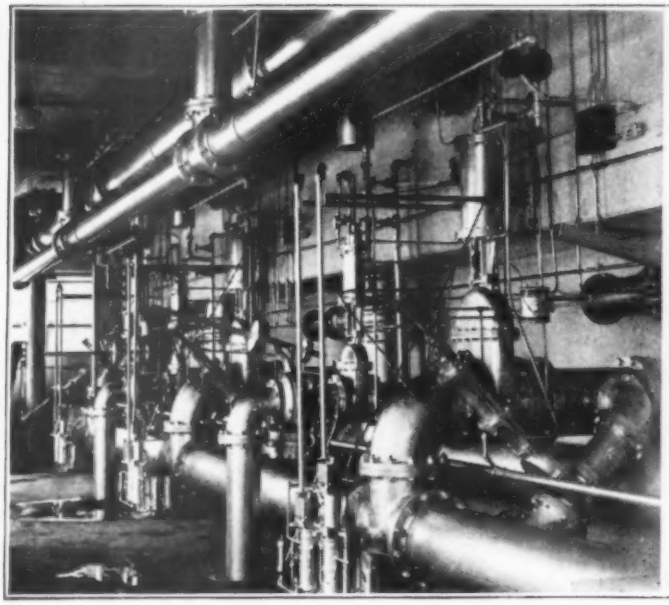
Equipment News

New equipment reaching the field during the year was confined mostly to auxiliary equipment. Five different companies brought out new chemical feeders: Infilco, Inc., Chicago, Ill., introduced a chemical solution feeder; Milton Roy, Philadelphia, Pa., announced the Constametric Pump and another Chemical Pump; Majax Co. of Dallas, Tex., brought out its Kem-Pump for controlled solution feeding; Liquid Conditioning Co., Linden, N.J., developed a new Chemical Feeding Device; and F. B. Leopold Co., Pittsburgh, Pa., introduced a new Dry Chemical Feeder.

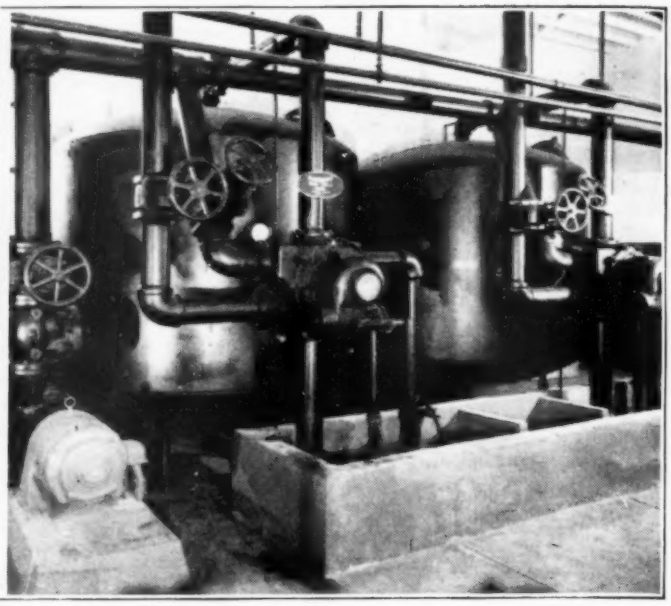
Still another chemical control device was the Automatic Chlorinating Unit developed by the Paddock Sales Corp., Dallas, Tex.

Curb Boxes of various material became available: The Fibre Conduit Co. of Orangeburg, N.Y., introduced a valve box made of Orangeburg Fibre Pipe; Verako Products Co. of Waukegan, Ill. developed the G-H Shock-proof Box using "Transite" Pipe; and the Opelika Fdry. Co. of Opelika, Ala., came out with a new design in cast iron valve boxes.

Walker Process Equipment Co. of Aurora, Ill., introduced the Clariflocculator, a coagulating unit using the principle of introducing water to be treated and chemicals into a previously formed slurry of precipitated solids. Also for the field of water treatment,



Permutit Zeo-Carb Water Softener at Sarasota, Fla.



Permutit Filter in Town of Fugate Springs, N. Car.

the Dorr Co. of New York City, developed a New Lime Slaker, and the Alhydro Corp. of Baltimore, Md., came out with the Electrolytic Floc Producer, described previously in this article.

For the distribution system, Northrop and Co., Spring Valley, N.Y., developed a Rubber Packing Gasket to replace yarn in making bell and spigot joints, and Payne Dean Co. of Madison, Conn., introduced the Portable Gatender, a portable valve operating machine.

In the matter of flow measurements, the Bethlehem Fdry. and Mach. Co., introduced the new Bethlehem Flo Tube, a variation of the Venturi Meter, and Infilco, Inc., Chicago, Ill., brought out a Rate of Flow Indicator. For checking meter operations and registration the R. W. Sparling Co., introduced its new Portable Flow Recorder.

Other new equipment available during the year was developed primarily for other fields and will find use in the water works field only in a secondary manner.

PUBLIC WORKS EXPANSION

1948-1949

In the *Monthly Labor Review* there is given each month an estimate of "expenditure for new construction (work put in place)", under two broad classes and numerous subclasses. The two broad classes are (1) Private Construction and (2) Public Construction. Under the latter there are 12 subclasses, of which three, (1) Highways, (2) Sewer and Water, and (3) Conservation and Development are of specific interest to civil engineers and contractors. The following table which is indicative, gives the totals for each of these three Public Construction subclasses for the years 1946, 1947 and the first 9 months of 1948.

	1946 12 months	1947 12 months	1948 9 months
Highways	$ 772,000,000	$1,233,000,000	$1,129,000,000
Sewer and Water	194,000,000	331,000,000	327,000,000
Conservation and Development*	240,000,000	396,000,000	590,000,000
Totals	$1,206,000,000	$1,960,000,000	$2,046,000,000

*Specifically the category includes the construction of dams, locks, reservoirs, levees, revetments, channels, canals, drainage ditches, pump houses, transmission lines, piers, etc., including appurtenant structures and essential community facilities.

It should be noted that for the first 9 months of 1948 the total has already exceeded that for the entire year of 1947, and is 70% greater than for the entire year of 1946. During the last 3 months of 1947 the expenditures for Highways were $240,000,000 or about 24% of that for the 1st 9 months of 1947. So if 24% of $1,129,000,000 be added thereto, it will make the probable total for 1948 more than $1,410,000,000, or nearly double that in 1946, and about 25% above that in 1947.

The expenditure for Water and Sewage Works in the last three months of 1947 was $95,000,000, or about 40% of that in the first 9 months. If 40% be added to the $327,000,000 spent in the first 9 months of 1948, the total for the year will be about $458,000,000. A similar estimate for Conservation and Development Works shows that about 40% may be added to the $590,000,000 during the last 3 months of 1948, bringing the year's total up to $825,000,000. Hence, these three classes of civil engineering works probably will total about $2,700,000,000 in 1948, or well over *double* that in 1946.

Because of the great backlog of needed civil engineering works, resulting from 4½ years of warfare, it is probable that in the year ahead (1949) there will be an increased expenditure of fully 30% over that of last year for such construction, exclusive of maintenance.—*Halbert P. Gillette.*

H. A. Stepleton Opens Consulting Office in Toledo

Harold A. Stepleton has announced the opening of his own office as a Consulting Engineer in the Spitzer Building in Toledo, Ohio, as of November 1, 1948. A graduate of Purdue University in 1925, Mr. Stepleton joined the firm of H. P. Jones & Co. (now Jones and Henry) in 1927, subsequently becoming a member. During the war Stepleton taught physics to Army Air Corps men at the University of Toledo. Since the war Mr. Stepleton has been Chief Engineer for Floyd G. Browne Associates, Marion, Ohio.

VIRGINIA SECT. A.W.W.A. FIFTEENTH MEETING IN RICHMOND

MORE than 250 members and guests attended the fifteenth annual meeting of the Virginia Section of A.W.W.A. held in Richmond, Va., on Oct. 25 and 26. An inspection trip, a banquet, a dance, and a special luncheon for the ladies in addition to a technical program were among the features which attracted this registration.

Chairmen

Incoming
H. E. Silcox
Asst.Engr.
Water Supply
C & O Railway
Richmond, Va.

Outgoing
M.J. Siebert
Sales Repr.
Neptune Meter Co.
Richmond, Va.

Business Session

Officers elected to serve the section for the ensuing year were as follows:

Chairman
H. E. Silcox, Asst. Engr. Water Supply
Chesapeake & Ohio Railway Co.
Richmond, Va.

Vice Chairman
E. C. Meredith, Asst. Dir.
Bur. of San. Engineering
State Dept. of Health
Richmond, Va.

Secretary-Treasurer
W. H. Shewbridge, Asst. Engr.
State Dept. of Health
Richmond, Va.

Trustees
W. W. Winfree, Engineer
Glamorgan Pipe and Fdry. Co.
Lynchburg, Va.

B. L. Strother, Filt. Plant. Supv.
DuPont Rayon Dept.
Richmond, Va.

A.W.W.A. Director (3 years)
H. E. Lordley, Asst. Dir.
Dept. Pub. Utilities
Richmond, Va.

Fuller Award

By unanimous decision of the Fuller Award Committee, it was the recommendation that the George Warren Fuller Award from the Virginia Section be conferred on WELLFORD HOPE SHEWBRIDGE, Asst. Engineer, Va. State Health Dept., Richmond, Va., and Secretary of the Section. The citation read, "For his outstanding service as Secretary of the Virginia Section, American Water Works Assn., and his efficient handling of the many assignments given him which has contributed greatly to the successful operation of the Virginia Section."

Inspection Trip

Following early morning registration, an inspection trip was made to the Richmond City Water Dept., for a practical demonstration of mechanical jointed pipe, valves inserted under pressure, and display of tools and equipment used by that department.

Fuller Awardee
W. H. Shewbridge
Asst. Engr.
State Health Dept.
Richmond, Va.
(Also Secretary)

Water Conservation

With Chairman M. J. SIEBERT, Dist. Mgr., Neptune Meter Co., presiding, the first technical paper was presented by D. S. Wallace, Dist. Engr., U. S. Geological Survey, Charlottesville, Va. Mr. Wallace spoke on "WATER SUPPLY CONSERVATION," and said that there are a number of factors which affect ground water recharge. Among these factors are type of vegetal cover, topography, runoff, and geologic structure. Most important is the intensity and distribution of rainfall during time of precipitation. Heavy rains and their attendant floods are necessary to the recharge of ground water, as well as providing ample surface supplies. Light frequent rains would not be sufficient. They would provide good vegetation but no penetration of the soil.

In Virginia studies are being made of both surface and ground water with the state being divided into three sections, the Piedmont, the Appalachian Valley, and Tidewater. As a result of studies, Mr. Wallace believes that reservoirs should be established over the state. A state wide authority will be needed to finance and build such reservoirs. Committees are now studying this problem.

For water supply studies, it is no longer appropriate to use precipitation figures; what is important is the runoff, which includes ground water release. Also important is the gain or loss in ground water level. A change in ground water level of one inch is important and amounts to a tremendous volume of water over the state.

For conservation of water, underground reservoirs would be ideal, but the geology of the state of Virginia is not conducive to such reservoirs and therefore above-ground storage is the answer to the problem in that state.

This topic was discussed by O. C. HOPKINS, Sr. San. Engr., Dist. No. 2, U.S. Public Health Service, Richmond, Va., who emphasized the importance of Mr. Wallace's proposals. A recurrence of the dust bowl in the west is not unlikely because water conservation has not been practiced. There are other localities where water supply shortages are important. These include California and other western states. Salt water encroachment along the seaboard is due to lack of water conservation.

Officers

Vice Chairman
E. C. Meredith
Asst. Dir.
Bur. of San. Engr.
State Health Dept.
Richmond, Va.

Director
H. E. Lordley
Asst. Dir.
Dept. Pub. Util.
Richmond, Va.

According to Mr. Hopkins, not only must we conserve water but we must also use it wisely and efficiently. Stream pollution abatement is important to water conservation, as is water metering, and prevention of water waste by air conditioning.

Programmers

D. C. Wallace
Dist. Engr.
U.S.G.S.
Charlottesville, Pa.

Dr. A. P. Black
Prof. Chem.
Univ. of Fla.
Gainesville, Fla.

Water Treatment Advances

Dr. A. P. Black, Professor of Chemistry, University of Florida, Gainesville, Fla., and Vice President of the A.W.W.A., spoke on "RECENT ADVANCES IN WATER TREATMENT." Dr. Black said that the most important development of the last ten years is the knowledge that has been gained about the mechanism of chlorination and the means of testing for residual chlorine. Although chlorination was started in 1908, it is only in the last few years that we have learned that it inhibits enzymatic action and thereby kills bacteria. Also, within the past few years it has been learned that free and combined residual chlorine are different in their effectiveness.

Of second importance perhaps is the knowledge learned of corrosion and its actions and effects. More books and papers have been written on that subject than any other recently. Dr. Black explained the electrolytic theory of corrosion and showed how it worked in the presence of water, where oxygen is present. He also showed how corrosion can take place in the absence of oxygen.

In 1824 Sir Humphrey Davy proposed a cathodic protection system to prevent corrosion of ships' bottoms. This theory of cathodic protection is now widely used in the prevention of corrosion of elevated tanks, pipes, etc. Sacrificial electrodes of magnesium are also being used to prevent corrosion. Dr. Black also spoke of the peroxide theory of corrosion.

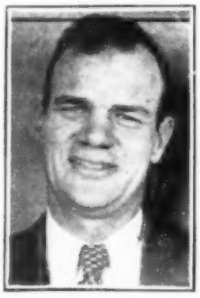
A new theory of taste and odor production has also been propounded by Prof. Silvey of Texas. According to his ideas and observations, tastes and odors do not come from algae but from the oil of protozoa, which follow the growth of algae.

In answer to a question from the audience, Dr. Black spoke about the use of fluorides in water treatment, telling of the several experimental installations and various attitudes toward the subject.

Pipe Line Cleaning

"CLEANING PIPE LINES" was the topic presented by W. A. Grant, Chief Engr., Newport News Waterworks Commission, Newport News, Va. Mr. Grant pointed out that inasmuch as a pipe may lose as much as 50 per cent of its capacity in 30 years, any money spent for cleaning is good insurance. Pipe cleaning may mean more pressure, volume, fire flows, etc.

First consideration should be given to transmission mains, particularly where pressure is maintained by pumping. Cleaning is done by contract, with the pressure method being used to move the cleaning machine in pipes of 8 inches and above and the drag method for pipes of 6 inches or less.



More Programmers

X. D. Murden
Supt.
Portsmouth, Va.

Whit. Cotton
City Engr.
Petersburg, Va.

Mr. Grant described the cleaning machine, and told about the process of cleaning and the preliminary work necessary before the cleaning begins. This includes selection of points of entry and exit, and cutting the main.

Cleaning at Newport News has been done every 7 to 9 years. A recent cleaning of 69,000 ft. (43,000 ft. of 18 in. and 26,000 ft. of 24-in.). Cleaning took place at the rate of one mile in 40 to 45 minutes. The cost of cleaning was approximately 10 cents a linear foot. Before cleaning, the "C" values for the two lines were 72 for the 18-in. line, and 82 for the 24-in. line. After cleaning the "C" value was 120 for both lines.

In discussing the paper, X. D. MURDEN, Supt., Water Dept., Portsmouth, Va., said that in 1942 he had cleaned 19 miles. Before cleaning the "C" value was 72; after cleaning it was 124. There has been little loss in "C" value since cleaning.

Motion Pictures

Two motion pictures were shown at the beginning of one of the sessions. The first was "DESIGN AND CONSTRUCTION OF A WATER COLLECTION AND TRANSMISSION SYSTEM." This was an excellent picture showing the use and application of "Transite" Pipe and was presented through the courtesy of the Johns-Manville Co.

The other picture was in color and showed the "INSTALLATION OF A 36-IN. VALVE INSERTED UNDER PRESSURE IN A 36-IN. CAST IRON PIPE MAIN." This film had been taken by the A. P. Smith Co. and showed an actual installation. Both of these films are available for showing at meetings and are well worth seeing.

Rules for Water Connections

Under the long title of "RULES AND REGULATIONS COVERING CITY WATER CONNECTIONS, POLICY, LOCATION, AND INCREASES PER CAPITA USAGE FOR FUTURE PLANNING," Chas. E. Moore, Manager, Roanoke Water Dept., Roanoke, Va., discussed various problems.

The reason a water utility should have rules is that it is a business and it should be run in a business-like manner. These rules have several reasons for being, including that of giving employees rules of conduct and letting the public know that it is receiving good service.

The rules to be set up depend on the locality and circumstances, but might be expected to include: Who will be accepted as a single customer, who will install the service, the size of the minimum service, a designation of use classification, location and ownership of meter and its maintenance and testing.

Other rules may be concerned with cross connections, flat rates, action against consumers who don't live up to agreement, grace period on bill payment, and of course the rate schedule itself.

And More Programmers

C. E. Moore
Manager
Water Dept.
Roanoke, Va.

M. C. Smith
Ch. Engr.
Pub. Util. Dept.
Richmond, Va.

For future plant requirements these items must be considered: when and how much to increase, unaccounted-for water, estimated new customers in future, estimated future per capita consumption. To determine these future estimates it is well to set up daily productions, losses, etc. and to project these into the future. One thing that must be known is the maximum to average demand.

Mr. Moore also spoke about his method for estimating unaccounted-for water which was described in full in his article "Accounted-For Water and Unbilled Revenue" on page R-100 of the April, 1948, number of *Water & Sewage Works.*

This paper was discussed by MARSDEN C. SMITH, Chief Engr., Dept. of Public Utilities, Richmond, Va. Mr. Smith said that regulations should "look out for" both the utility and the customer. But Mr. Smith warned that regulations were often unnecessary. On the other hand, Richmond has made some rather definite regulations regarding service, as were described in Mr. Smith's article "Standard Design for Water Services" on page R-69 of the April, 1948, number of *Water & Sewage Works.*

Emergency Service

Whitworth Cotton, City Engr., Petersburg, Va., spoke on "EMERGENCIES IN CITY WATER SERVICE," mentioning weather emergencies, the need for duplicate units at weak points, and the need for standby power. A superintendent should insure himself by having adequate supply, pumping capacity and chlorination facilities. For stand-by power there should be available at least 60 to 70 per cent of the maximum daily demand.

Routine testing of equipment and chlorination during any pipe breakage are necessary.

In discussing this topic, H. E. LORDLEY, Asst. Dir., Pub. Utilities, Richmond, said that it is a good idea to find out where there is a local machine shop that can repair motors, chlorinators, or dry feeders in case of emergency. Lordley also recommended that an emergency stock pile be maintained, and that distribution systems be kept up to date. He also recommended that operators and superintendents read the technical magazines in order to get ideas that will be helpful, not only in emergencies but also in general operations.

Caught in the Camera

R. C. Bardwell, Supt., Water Supply C. & O. Railway, Richmond
H. G. Erb, Dist. Mgr., Pitts. Pipe Cleaning Co. Baltimore, Md., and
R. D. Wright, Supt., Lynchburg, Va.
A. P. Rudder, Dist. Mgr., W & T, Washington, D.C.

Color Code

In a paper on "PAINTING OF CONCRETE STRUCTURES, PIPE LINES, AND WATER EQUIPMENT," C. L. Crockett, Chief Chemist, N & W Railroad, Roanoke, Va., spoke about code of colors for pipe lines, use of cork and application to prevent condensation for temperature differentials.

Industrial plants are now being decorated with colors chosen not only for safety reasons but also to make for better working conditions and less worker fatigue. It has been found that there is a big return in efficiency from plants so painted. In a machine shop, for instance, the walls may be light green, with the machines a darker green, and with operating sections of machines a focal ivory, and dangerous parts of machines a focal orange.

Lovely Ladies

Frances Saunders, Secy. to X. D. Murden in Portsmouth Water Dept.
Mrs. Mike J. Siebert of Richmond
Fae Wilson, Clerk-Steno., Portsmouth Water Dept.
(Frances and Fae entertained as singers at the banquet, and "Shorty" Siebert was a most lovely first lady)

The American Standards Assn. has developed a standard code for safety. There are five classes of colors as follows:

Fire Protection Equipment	Red
Dangerous Materials	Yellow-orange
Safe Materials	Green (white, black or gray)
Pure Materials	Blue
Extremely Valuable Materials	Dark Blue

In a water plant these colors will be used:

Alum solution	green
Carbon dioxide	yellow
Chlorine	yellow
Ammonia	yellow
Soda Ash	green
Water	green
Steam	yellow
Water, fire protection	red

Regardless of the colors used, use bright colors.

For painting concrete masonry, it is wrong to use linseed oil type vehicles because the lime present will saponify the oil and the paint won't hold. For concrete use a resin type of paint of which there are many types available. Chlorinated rubber paints are best for this purpose with phenolic resin paints next best. Where moisture is conducive to mildew, chlorinated rubber is recommended; where moisture is extremely high use a mildewcide, of which there are several kinds.

Also Programmers

C. L. Crockett
Chief Chemist
N & W Railroad
Roanoke, Va.

B. L. Strother
Water Supv.
E. I. Du Pont
Richmond, Va.

For machines, use an acid and alkali resistant paint. Vinyl resin types are best with the proper pigmentation. For exteriors of iron and steel tanks, thorough preparation and cleaning by sand blasting or wire brush should be done a short time before painting. The first coat should be rust inhibitive.

To prevent sweating of pipes ground cork has been effective, as has asphalt and vermiculite (iron sulfide), or asphalt and asbestos cut back with gasoline. This has very good insulating properties.

In discussing this subject, B. L. STROTHER, Water Plant Supervisor, E. I. DuPont Plant, Ampthill, Richmond, Va., said that the proper preparation of the surface is very important. There is a zinc chromate paint that has been found to stop galvanic action corrosion and it is now being used by the U.S. Navy. Silicone paints are being found effective for heat resistance.

Following the technical papers, there was a short Question Box session conducted by H. E. SILCOX, Engr., Water Supply Division, C & O Railroad, Richmond, Va.

SMALL WATER TREATMENT PLANTS*

Some Comments on Design Features, Operating and Personnel Problems

by
THOMAS R. LATHROP
Prin. Asst. Engineer
OHIO STATE DEPT. OF HEALTH
COLUMBUS, OHIO

TO a great extent, the problems of the small and large treatment plant are similar. The raw waters of both produce the same problems of purification, including chemical application, filtration and disinfection. The differences in operation are the result of differences in plant design and also in the type of personnel usually employed.

A plant with a capacity of 0.5 mgd. or less is considered a small plant. The plant operator usually is responsible for the entire system, from operating low-service pumps to reading the meters and sending out the bills. This discussion, then, will be confined to plants of 0.5 mgd. or less. Even in this category, many plants are provided with the same features as larger ones, and treat waters presenting similar problems of turbidity, tastes, odors, hardness and bacterial contamination. Some small plants also have well-trained operators. But differences in design, operating conditions and personnel problems do occur.

All water treatment plants constructed in Ohio must have the approval of the Ohio Dept. of Health. A few of the regulations governing these plants are: (1) The rate of filtration required is 2 gpm. per square foot in purification plants using surface waters. In the case of softening and iron removal plants, using ground waters, a 3 gpm. rate is permitted. (2) Filter rate controllers are required on all filters. (3) Open gravity filters are required for all surface waters, but pressure filters are permitted in softening plants which treat ground waters. (4) Settling basins having at least four hours' detention are required at all plants using surface waters, although for ground waters which are softened shorter detention periods are allowed.

Design Features

The construction of completely new water works including treatment plants so taxed some of the small

The Author

municipalities that the water works structure was not made large enough to provide space for chemical storage. The filters reach almost to the roof, making it very difficult to get into a filter and even more difficult to remove and replace the sand and gravel. At some plants of this sort a small building adjacent to the filter building is used for storing chemicals. Such arrangements add to the problems of operation, however.

Reaction and Settling Units

Cylindrical steel reaction and settling tanks, which are often employed for economy's sake, usually afford rather inefficient mixing. In some plants where the lack of effective mixing has been noted, the addition of mechanical mixing devices has improved conditions. When lime-soda softening is involved, the steel tank serves as a mixing chamber, settling basin and recarbonation basin, with recarbonation occurring in the outtake pipe. The water is generally not stable when it reaches the filter, and the sand encrusts rapidly.

Filter Washing

Surface washing not only keeps the sand in filters in clean condition, but in the softening plant it reduces the rate of incrustation of the sand. In the small plant, surface washing can be provided from piping which is usually on hand. A small grid of 1-in. pipe placed in such a filter makes an excellent surface washer. It is simple to construct and is so small that it can be easily handled if it becomes necessary to remove it from the filter.

Chemical Feeding

Chemical application for the small plant is best provided by using solution feeding devices. Few of the dry feeders will apply chemicals accurately in the small amounts usually required. Too often the chemical storage space is in the same room as the filters and pipe gallery, where moisture conditions affect the chemicals—especially lime and soda-ash—so that they cannot be fed accurately by any volumetric dry feeder. Incidentally, accuracy of chemical application is more important in the small plant than in the large one. Over- and undertreated waters are much more apt to reach consumers in small communities. In spite of this, many small plants continue to be equipped with dry feeders which give no end of trouble.

Recarbonation

The recarbonation of lime-softened water presents many problems in all plants, and the small plant is no exception. When natural gas is available, a gas burner is usually employed for producing carbon dioxide. Kerosene burners are generally more satisfactory in the small plant than coke burning furnaces, because operation is usually intermittent and a small coke fire is difficult to keep burning. Recarbonation units employing dry ice (solid CO_2) are of great advantage, although the cost is perhaps somewhat more than for carbon dioxide generated as a product of combustion. There is no problem of generation or compression; the dry ice is delivered in sizable blocks which are cracked up and placed in a screw-capped pressure cylinder. The gas coming from the top of the cylinder is measured by a rotameter and diffused through a submerged fabric hose of the type used for watering lawns or gardens and sold under the name "Soil Soaker." Excellent results are reported.

In some small lime softening plants, recarbonation is not practiced because of the difficulties involved. Vitreous phosphate* known as "Calgon" is ap-

*This paper, presented before the Annual Meeting of the Am. Water Works Assn., is here published by the permission of the Association.

*Produced by Calgon, Inc., of Pittsburgh, Pa.

plied in an effort to offset the effects of water saturated or super-saturated with calcium carbonate. This treatment prevents the incrustation of the filter sand, pipelines, meters, etc.—but, if water is treated with excess lime, the vitreous phosphate does not remove the causticity and a caustic taste often remains.

Filters

Pressure filters are installed as an economy measure at certain small water treatment plants. In Ohio, the installation of pressure filters is discouraged and such units are permitted only at plants designed for ground water softening or iron removal. Very little need be said about the disadvantages of this type of equipment. Tastes and odors at times develop in these units as a result of biological growths. The sand cements together, and overhauling such filters is a disagreeable job.

Gravity filters are occasionally constructed using steel shells, some as small as 5 or 6 ft. in diameter. Concrete units providing 25 sq. ft. of filter area are about the smallest size that should be constructed. Smaller units are too difficult to work in during construction and overhauling operations.

Rate Control

Rate controllers are most economically constructed for one or two filters by employing a float chamber which provides a constant head over an orifice. The only problem of operation is to keep the float valve working freely. Putting a proper cover over these controllers is quite important if foreign matter is to be kept from the clear well. The type of rate controller usually supplied employs a hydraulic valve actuated by pressure on a diaphragm and is very satisfactory in the plain filtration plant. It is of little use in many lime-soda softening plants because the pilot becomes encrusted and the controller fails to function. If vitreous phosphate is introduced into the water ahead of the filters, this trouble is eliminated. However, a water harder by 20 ppm. may be expected when this chemical is applied to the water before filtration.

Pumps

Pumps in the softening plant using pressure filters usually take suction from the settling tank discharging through the filter into the distributing system. In softening plants this arrangement has the serious drawback of causing incrustation of the pump runner and housing, making it necessary to take the pump out of service about once or twice a month for removing calcium carbonate. This coating is very hard and crystalline in character. An acid bath is the most effective method of cleaning. To remedy the condition, the high-service pumps may be arranged to take suction from the filter effluent instead of the influent. When the water passes through the filter before it reaches the pump, it has become more stabilized and little further trouble is experienced with incrustation. Vitreous phosphate applied to the suction of the pump will also prevent incrustation of the pump by calcium carbonate.

Filter Washing

A wash water tank is usually lacking in the small plant. Sometimes a pump is provided, but very often the wash water is drawn from the main discharge of the plant to the distribution system. This is practical if there is an elevated tank on the system and if the filters require only a relatively small amount of wash water. At one plant, with a 6-in. force main about two miles long, the single filter was divided into two parts for washing purposes, so that enough wash water would be available from the small force main with its high friction loss. It is desirable that an auxiliary gate valve regulating the rate of filter wash be placed on the main wash water line so that wash water valves on each filter can be opened wide without danger of upsetting the sand and gravel bed.

Automatic Controls

Clear wells have been omitted in some small plants in order to reduce the cost. Pumps take suction directly from the gravity filter effluent line and discharge into the distribution system. An elevated tank usually floats on the system, but sometimes a pump with automatic controls discharges into a hydropneumatic tank. The pump is in frequent operation during certain parts of the day. At some plants, the pumps will start as often as once a minute, operating for from 10 to 15 seconds at a time. Treating water under these conditions certainly presents problems which the large plant operator never encounters. Automatic equipment, actuating low-service pumps, chemical feeders, filters and the like, materially facilitates operation of a plant of this type.

Operating Problems

Raw waters from impounding reservoirs often contain algae. For the most part, the small plant operator does not determine what organisms are involved but employs copper sulfate in varying amounts at different locations. Usually the copper sulfate is applied on more or less of a schedule, such as once or twice a month. If the conditions are not improved, a supervising chemist may be called upon to advise a treatment.

The aeration of well waters is frequently accomplished adjacent to the filter building. Spray from the aerator saturates a brick building wall and the chemicals stored inside near the wall will take up so much moisture that it becomes impossible to feed them with a dry feeder. Separation of the aerator from the building is advisable.

Mixing devices at some softening plants require a great deal of maintenance because the small plants operate intermittently. Sludge collects on the bottom of the basin during the period of shutdown and makes it difficult to start the mechanism, with breakage often resulting.

The operation of filters in the plain filtration plant is largely a matter of keeping the filter material clean and free from mudballs. In the lime softening plant, the problem of maintaining filters is much more serious. The sand becomes heavily incrusted and at times cements together, forming large chunks and slabs. The operator must be continually on the watch to prevent this condition. The filters should be prodded with a long-handled rake each time they are washed, so that the operator may know the condition of the sand. As previously stated, a surface wash system will prove very helpful in preventing sand agglomeration. Frequent removal of sand from the surface of the filter is necessary to keep the sand level at a point below the bottom of the wash water troughs. When sand is heavily incrusted, little or no sand expansion takes place during the washing operation. The effective size of the surface sand often reaches 2 mm. or more. Below the surface the size is much smaller.

In washing purification plant filters, the operator must learn to work the wash water valve slowly. Valves in small plants are usually manually controlled and often cannot be opened too rapidly, but many are opened fast enough to upset the gravel layer. The carborundum-plate filter bottom which is coming into use should prevent troubles resulting from displaced gravel layers.

Tastes and odors are attacked in the small plant in about the same manner as in the large one. The operator of a small plant does not have the facilities for making threshold odor tests. And he may not have the train-

ing to test for *free residual* chlorine. Activated carbon and combined chlorine are usually employed for taste and odor control. *Free residual* chlorination is used for taste removal at a few small plants where the operator is competent to control it.

Disinfection at the small plant is usually best accomplished with hypochlorite rather than with liquid chlorine, because the use of hypochlorite is, overall, more economical as well as being more simple in operation.

The maintenance of the plant in a neat condition is more of a small than a large plant problem, as the small plant often has no space for storage and becomes cluttered up with all sorts of equipment. In building small water works plants provision must be made for chemical storage, tool and meter room, and general storage space if anything approaching neatness is to be attained by the operator.

A small amount of effort toward landscaping the works will greatly improve its appearance. The planting of trees and shrubs can be done with no outlay of money because individual citizens or the garden club can be depended on for material if the water works man indicates an interest.

Personnel Problems

In the small plant the water works income is often so restricted that the salary which can be paid to the operator is insufficient for full-time employment at the water treatment plant. Usually, in addition to operating the purification plant, he looks after the pumps and the distribution system, makes taps, reads the meters, sends out the bills and collects the revenue. He frequently ekes out a living by acting as town marshal, driving the school bus, running a motion picture theater or acting as janitor of the school. Such versatile men are operating some of the small plants.

These operators, who make regular daily coliform, alkanity, pH and hardness tests, generally had no formal education beyond high school. Many have had none beyond the eighth grade. They have acquired their technical knowledge from men who have been employed to supervise the works and from the study of books and technical publications. On the other hand, many small plant operators are satisfied to permit the supervising chemist to direct the plant operation and they carry out his orders. It is necessary at all plants treating surface waters that the operator be an intelligent man with some initiative, because it is not possible to operate such a plant by following orders issued once a week by a supervisor. At a softening plant using ground water, the problem is quite different. The supervisor adjusts the treatment for a given type of water with reasonable assurance that the water will remain of uniform quality, with no changes in treatment necessary before his next visit.

Some explanation should be made about the supervision of small plants as it is practiced in Ohio. Regulations of the State Health Dept. require that operators in responsible charge of water purification plants hold one of three grades of certificates issued by the Director of Health. Plants which treat surface waters must have a man in charge who holds either an *A* or *B* certificate, the class required being determined by the size of the plant and the character of the raw water supply. Small plants in which the operator does not have the necessary qualifications for a *B* certificate must be supervised by a man holding an *A* or *B* certificate. The supervisor is then in responsible charge of the plant. How much instruction he gives the plant operator is really a matter between himself and the operator. Some operators are anxious to learn the technical phases of water purification, while others are satisfied to let the supervisor take responsibility for the plant's output. For the most part, however, the operators of small plants make an effort to improve their status by preparing themselves for the examinations which are held annually for the various certificates. This system of supervision of water plants has been in successful operation for more than 25 years in Ohio. The certification of plant operators, however, was begun only eleven years ago.

In an effort to improve filter plant operation, Ohio is following the lead of some other states in establishing a short school for small plant operators. Its first session, held in 1948 at Ohio State University, was largely devoted to elementary and basic training. No decision has been made as to the eventual schedule of training, but the purpose of the school is to raise the operators (through training) to a higher level of competence.

Nussbaumer, Clarke & Velzy, Cons. Engrs. of Buffalo and New York City

Nussbaumer and Clarke, Inc., Cons. Engrs. of Buffalo, N. Y., have announced the addition to the firm of Charles R. Velzy and the change of the firm name to Nussbaumer, Clarke & Velzy, Inc. In addition to the office at 327 Franklin St. in Buffalo, a new office has been opened at 52 Vanderbilt Ave., in New York City. This office is to be under the direction of Mr. Velzy.

The firm of Nussbaumer and Clarke has been active in western New York state and Pennsylvania for more than fifteen years and has designed a number of water and sewage works as well as drainage and flood control projects and garbage and refuse incinerators. Mr. Nussbaumer is a former public works commissioner of the City of Buffalo and is active in city planning associations. At the present time he is a member of the N. Y. State Board of Examiners for Professional Engineers License, and he is a past president of the N. Y. State Sewage Works Assn.

Mr. Velzy was formerly Resident Engineer for Greeley and Hansen during design and construction of the Buffalo Sewage Treatment Works and was the first superintendent of that plant, having held the position for four years, before coming to New York in charge of an office for Greeley and Hansen, Engrs. For the past two years he has been in charge of sewage treatment works design for Buck, Seifert and Jost, in New York City, and a lecturer in Hydraulics and Sanitary Engineering at Cooper Union University. During the war, Mr. Velzy was consultant to the Army Engineers and designed the sewage treatment plant for the Pentagon Building. He is also a past president of NYSSWA.

The firm will continue to specialize in the design and supervision of construction of sewer systems and sewage treatment plants, pumping stations, water supply systems, drainage and flood control projects, garbage and refuse incinerators, site planning, the design of service utilities, and industrial waste treatment.

Standards of Hydraulic Institute

The 8th Edition of the "Standards of the Hydraulic Institute" has been completely revised. This edition is an 8½ x 11 inch publication and consists of six sections: General, Data, Centrifugal Pump, Rotary Pump, Reciprocating Pump and an entirely new section containing tentative standards on Pipe Friction.

This 82-page book is published by the Hydraulic Institute, 90 West Street, New York 6, N.Y., and retails for $3.00 a copy.

ROCKY MOUNTAIN SECTION MEETING HELD IN CHEYENNE

Reported by

HARRY A. FABER*
Editorial Associate
WATER AND SEWAGE WORKS

CHEYENNE, Wyo., was host to the twenty-second annual meeting of the Rocky Mountain Section A.W.W.A. on September 16th and 17th. According to custom, the Rocky Mountain Sewage Works Association held its meeting (the twelfth annual) one day before, thus enabling members of each association to attend both meetings.

New Officers

Chairman
Henry Krull
City Clerk
Sterling, Colo.

Vice-Chmn.
B. V. Howe
Cons. Engr.
Denver, Colo.

In addition to a full technical program, business meetings, the round table discussions and social events provided many events of interest. The members and guests were welcomed by Mayor Ben Nelson of Cheyenne. L. O. Williams (Dir. Div. Public Health Eng. and San., Cheyenne, Wyo.) presiding at the first session, then welcomed Harry E. Jordan, Secretary of the A.W.W.A.

Mr. Jordan reviewed the present problems of the water works industry, placing emphasis on planning for the next two years. No Federal agency exists to handle priorities on municipal projects, though reconstitution of something comparable to the wartime organization of this nature is expected. A broad estimate of needs in the field is to be based on a new A.W.W.A. utility survey now in progress. In discussing current problems, Mr. Jordan commented on chlorine availability, summarizing the reasons for shortages and the cooperation required to maintain service without interruption.

New Officers Elected

In its business session, the Section elected new officers to serve for the coming year:

President
Henry Krull, City Clerk
Sterling, Colo.

Vice-President
B. V. Howe, Cons. Engr.
Denver, Colo.

Secretary-Treasurer
O. J. Ripple, Cons. Engr.
Denver, Colo.

Trustees, 3 yr. terms
John Burgess, Office Engineer
Denver Water Dept.

and

Lee E. Talant,
Water Supt.,
Estes Park, Colo.

National Director
Dana E. Kepner, Mfrs. Repr.,
Denver, Colo.

Technical Papers

In his paper titled "CONSTRUCTION COSTS," Robert L. Streeter, Cons. Engr., Casper, Wyo., summarized useful data which has recently been published in professional journals. Among the conclusions: prewar prices will never return, and prices will continue to rise; the proportion of skilled labor in the job is an important consideration; structural steel, concrete, and earthwork are particularly costly. Expectations for the coming year are that competition will increase, the manpower situation will improve, and dependable prices will be more prevalent.

New Officers

Secy.-Treas.
O. J. Ripple
Cons. Engr.
Denver, Colo.

Natl. Dir.
Dana Kepner
Mfr. Rep.
Denver, Colo.

"THE CHEYENNE MUNICIPAL WATER SUPPLY" was described by F. M. Veatch, Black and Veatch, Cons. Engrs., Kansas City, Mo., who dated the inception of this supply in the early 1880's. Infiltration galleries along Crow Creek provided water from about 6 miles above the city; at that time water quantity was considered more important than quality, but the supply soon became inadequate in quantity. In 1894, farther up the creek, the City constructed a reservoir.

*Research Chemist, The Chlorine Institute, Inc., New York, N.Y.

Program Participants

C. A. Davis
San. Engr.
Denver, Colo.

F. M. Veatch
Cons. Engr.
Kansas City, Mo.

Geo. J. Turre
Bd. Wtr. Comm.
Denver, Colo.

L. Dodson
Health Dept.
Denver, Colo.

L. C. Osborn
San. Engr.
Denver, Colo.

L. O. Williams
Bd. of Health
Cheyenne, Wyo.

C. T. Wright
U.S.P.H.S.
Denver, Colo.

A filtration plant was built in 1915, after two rather severe typhoid epidemics, but the firm yield is believed to be about 4.5 mgd. A program of ground water development was started

Programmers

D. J. Homan, Water Dept., Denver, Colo.

R. L. Sherard, Supt. Water, Cheyenne, Wyo.

in 1933 and has been continued ever since. Eleven wells are now in service (total maximum yield is about 2.0 mgd.) and others are ready for service. It appears that water needs for the next 25 years may be met by the development of new wells and, at the same time, by rigid conservation requirements.

It is probable that the reclamation of sewage effluent for industrial use will constitute a most promising contribution to the solution of the problem. Industrial demands are now roughly 30 per cent of the total consumption. The cost of effluent treatment would be less than the cost of well development. The reclamation of sewage effluent, Mr. Veatch indicated, provides an inexhaustible supply, and will generally be utilized in certain areas of the country.

In discussing this paper, Ray L. Sherard, Water Superintendent, Cheyenne, stated that the eleven wells now in use range in depth from 200 feet to 1100 feet. To date, 58 wells have been drilled and only 28 have proven satisfactory. The final water system of the city will continue as a combination of surface and ground water.

"PUBLIC RELATIONS," according to Lewis Dodson, Director, Sanitation Division, Denver City-County Health Dept., may be either a liability or an asset. Speaking enthusiastically of their development as assets to any utility, Mr. Dodson described the formulation of policies and programs. He advocated education on all levels of the organization to develop an "esprit de corps."

The customers can then be educated, particularly by personal contact—one such method being offered in telephone conversations. Letters should be answered promptly and considerately. The confidence of local newspapers should be established; radio publicity and contacts with service organizations should be utilized. Good public relations are important whether the utility is publicly or privately owned.

Revision of Water Rates

One morning session was devoted to group discussion, of which three were scheduled. The first of these, titled "NEED FOR RATE REVISIONS," was led by Harry E. Jordan. As background, he quoted from the U.S.-P.H.S. Survey of Sanitation Needs (Supplement 204, Pub. Hl. Reports, which may be obtained from the Supt. of Documents, Washington, D. C., at 15 cents per copy).

The data show that water works needed in the States of Colorado, New Mexico, Utah, and Wyoming total 134, improvements to plants or systems total 686, and the estimated overall cost is 110 million dollars. Obtaining money for water works, like any municipal improvement, is very difficult.

It is estimated by Howson that 55 per cent above prewar costs is now needed to be in keeping with present costs. Mr. Jordan pointed out that, if water rates have not been raised, either (a) the prewar rates were too high, (b) the plant is depreciating, or (c) the authorities are not facing facts. When a rate increase is needed, plans should be explained to employees and then should be publicized.

F. M. VEATCH advocated that metering should be adopted and the rate structure should be examined; that is, first the water and then the dollars should be accounted for. H. G. WATSON said it is no solution for councils to save money by cutting

Programmers

M. Leonard, San. Engr., Denver, Colo.

H. G. Watson, City Engr., Cheyenne, Wyo.

down on employees, despite the fact that water bills are being paid in 40 cent dollars.

A paper on "UNACCOUNTED FOR WATER" prepared by D. D. Gross, Chief Engineer, Denver Water Department, was read by D. J. Homan, Draftsman of the Department.

There are legitimate uses of water, not measured, which add to the amount of "water not delivered to the consumer." An important factor affecting losses, however, is the underregistration of meters (generally from 2 to 5 per cent, in older meters). Mr. Homan's paper described practice followed by the City of Denver in making surveys and maintaining records for all uses of water. THOS. J. EATON, Santa Fe, explained how more than 88 per cent of water was accounted for by his privately owned utility. CARL M. BENNETT, Grand Junction, Colo., said about 75 per cent of his public supply could be accounted for.

Discussion of Water Sources

The discussion of "GROUND WATER" was started with a paper presented by Don Warner, Ground Water Division, U. S. Geological Survey, Denver. This reviewed the technical and political factors involved in state compacts, allocation, and inter- and intra-state problems.

About three-quarters of the water supplies in Wyoming utilize ground sources. The investigations underway and being planned relate basically to irrigation uses, but are found to be of considerable assistance to municipalities. Existing Federal legislation is inadequate to provide needed ground water control. Since many wells are depleted, and deep supplies are frequently necessary, further investigations by the Geological Survey are important for insuring future needs.

Some of the Wives

(1) Mrs. W. V. Leonard, Cheyenne, Wyo. (2) Mrs. H. J. Rosenthall, Chicago, Ill. (3) Mrs. A. D. Mars, Jr., Denver, Colo. (4) Mrs. C. M. Bennett, Grand Junction, Colo. (5) Mrs. C. A. Davis, Denver, Colo.

Programmers

R. L. Streeter, Cons. Engr., Casper, Wyo. | *C. M. Bennett, Dir. Pub. Wks., Grand Jct., Colo.* | *L. A. Young, Denver, Colo.* | *B. G. Davis, Supt., Rawlins, Wyo.* | *B. Coy, City Engr., Ft. Collins, Colo.* | *C. R. Cederburg, W & T, Denver, Colo.* | *A. D. Mars, Neptune Meter, Denver, Colo.*

Dana Kepner, Denver, asked whether wells might be considered to remove surface water before it became surface water. H. G. Watson, Cheyenne, discussed the proper classification of wells located close to streams; are these ground water or surface water?

Main Disinfection

C. T. Wright, Sr. San. Engr., U.S.P.H.S., Denver, led the discussion of "WATER MAIN DISINFECTION." The contamination is usually due to introduction of pollution when the mains are laid, and may best be corrected by cleaning the pipe and swabbing with a disinfectant on the day the lines are laid. Some states have regulations requiring the sterilization of newly installed or repaired lines.

The joint packing material may constitute a contamination problem. Rubber rings, asbestos rope, braided cotton, and hemp were given that order of preference. The completed line should be thoroughly flushed and then should be chlorinated, using chorine water from a chlorinator, or direct chlorine gas feed, or a solution of high test hypochlorite, applying the disinfectant through a tap on the pressure side of the valve.

A residual of at least 40 to 50 ppm. chlorine should be reached, and the treated water should stand for a minimum period of 24 hours before flushing. Bacterial samples should be taken and examined before putting the main in service. Repeated treatment may be required. Where it is impossible to hold the line out of service, the continuous treatment of water flowing through the main to provide a residual of 0.5 to 1.0 ppm. free available chlorine for a 30 day period was recommended.

A round table discussion of the topic "CURRENT PRACTICE IN WATER MAIN EXTENSIONS" was led by H. G. Watson, City Engineer, Cheyenne.

HARVEY T. MUNN, Hydraulic Engineer, Natl. Board of Fire Underwriters, Chicago, presented a discussion of exceptional interest relating to "INTERRUPTIONS AND BREAKS IN WATER SYSTEMS."

The topic of "CHLORINATION" was broadly covered in a paper by Harry A. Faber, Research Chemist, the Chlorine Institute, New York.

Gilbert Associates Expand Sanitary Engineering Staff

The Sanitary Engineering Staff of Gilbert Associates, Inc., Reading, Pa., has recently been expanded according to an announcement by R. W. Simpson, Head of that department.

Robert J. Schatz, formerly with the Pennsylvania Department of Health, has joined the Reading office of the company. A graduate of Penn State in 1942, and with a Master's degree in San. Engr. in 1946, Mr. Schatz inaugurated the research program of the Health Dept. on abattoir wastes. In his new position he will work on industrial wastes and sewage treatment plant design.

Two new staff members have also been assigned to the recently opened Houston, Tex., office of the firm. Eric J. Hanemann, a graduate of Tulane University in 1929 has come to the organization from a fellowship of the Nat'l. Foundation for Infantile Paralysis at the University of Texas, where he obtained a Master's degree in Sept. 1948. Mr. Hanemann had formerly been employed by the New Orleans Sewerage and Water Board, U. S. Bureau of Public Roads, U. S. Navy, and the Orleans Levee Board.

The other new member of the Houston office is Joseph H. Brendlen, a graduate of Newark College of Engineering in 1926. Mr. Brendlen was recently associated with the firm of S. T. Powell, Cons. Engrs., and was stationed in the southwest. Before that he had been associated with Fraser Brace Engr. Co., and the Filtration Equipment Co. as sanitary engineer.

First Annual Penna. Water Works School

The 1st Annual Pennsylvania Water Works School was held October 25-29 at State College, Pa. It was conducted by the School of Engineering of Pennsylvania State College and was sponsored by the Penna. Water Works Operators Assoc., the Penna. Dept. of Health, and the Institute of Local Government and Extension Services of Pennsylvania State College. Enrollment was limited to one hundred applicants.

The four and a half-day short course included demonstrations on water treatment, water chemistry, chemical mixing, coagulation and sedimentation, filtration, mechanics of filters, problems of filtration, reports and records, pumps, flow meters, recorders, gages, etc., also calculations, bacterial quality, disinfection, chlorination, chlorine control, and safety in handling chlorine, water sampling, taste and odors, corrosion, laboratory tests; and the elementary liquid flow demonstration which was the highlight of the Penna. Water Works Operators Association at State College in August.

In addition to members of the Penn. State School of Civil Engineering, fourteen guest lecturers made up the staff of the short school. These included A. I. Andrews and A. E. Griffin of Wallace & Tiernan; R. C. Bigelow, Penna. Salt Mfg. Co.; Charles E. Coleman, DeLaval; L. S. Duckworth, Supt. of Filtration, Lancaster; Martin Flentje, American Water Works Co.; Wayne A. Kivell, The Dorr Co.; H. N. Lendall, Rutgers University; L. S. Morgan and D. Paul Rogers, Penna. Dept. of Health; G. A. Rohlich, Univ. of Wisconsin; E. A. Sigworth, Ind. Chemical Sales; F. E. Stuart, Stuart Corp.; E. F. Twomey, Morris Knowles, Inc., and Alan A. Wood, Builders-Providence.

RADIO TALK ON WASTE TREATMENT*

by

DR. B. A. SOUTHGATE

Director of Water Pollution Research

BRITISH DEPT. OF SCIENTIFIC AND INDUSTRIAL RESEARCH

IT MAY not be easy to realize how difficult it is to provide adequate supplies of water in a country such as Great Britain, in which a large population and so many industries are crowded together in so small a space. In the first half of the nineteenth century, when the industrial system was developing in Britain, many factories and towns were built on rivers where clean water was available. The problem of disposing of the waste products from these towns and factories however, was not given much attention, and sewage and polluting waste liquors from industry were frequently discharged to rivers without treatment. One result of this was that there were serious outbreaks of water-borne diseases; another was that a factory, which had settled on a particular river in order to make use of the clean water, later found that it was being so fouled by a discharge further upstream that it was unsuitable for the processes of manufacture.

This is another paper to illustrate how talks on water and sewage treatment may be tailored for nontechnical audiences.—The Editors

Early Treatment

A great deal has been done since the early days of the industrial system in developing methods of treatment of water and of sewage and industrial wastes. Water-borne disease in Great Britain is now rare and outbreaks are, as a rule, the result of some accident. On the other hand, both the volume of water and the standard of quality required in industry and in the household are always tending to increase.

The first satisfactory method of treating water-borne sewage was by irrigation on land. In the most effective process of irrigation the sewage was distributed as evenly as possible over the land, through which it percolated downwards and was carried away in drains beneath the surface. In passing through the soil the sewage was purified as a result of very complex processes, many of them due to the activity of bacteria and other organisms. Disposal of sewage by irrigation requires a large area of land, and, unless properly controlled, gives rise to nuisance from smell. As towns became bigger, more effective means of treatment were wanted. A great improvement was made by the development of what is known as the percolating filter. This consists of a bed of stones or other hard material, carefully graded in size so as to give the maximum volume of air space between the pieces of medium. The sewage is first passed through tanks to allow the sludge to settle out and is then distributed evenly over the surface of the filter by means of a mechanical distributor. The bottom of the filter is arranged with drains and ventilating holes so that there is free access of air to all parts of the bed. By this means, the processes of purification which would take place slowly in the soil are greatly speeded up, and consequently, the area needed to treat a given volume of sewage is correspondingly reduced.

Improvements in Processes

Research has been going on for many years with the object of improving still further the operation of percolating filters and in the last few years striking improvements have been made. For example, the British Water Pollution Research Laboratory has developed a new process called "alternating double filtration" by which at least twice as much sewage can be purified in a plant of given size as by the older method of filtration. A weakness in the older method was that if a filter was overloaded with sewage the air spaces between the stones became choked with growths of bacteria and fungi, and in time, the filter might become entirely blocked. In alternating double filtration two filters are used in series, and growths are removed by reversing the flow periodically so that each filter in turn is treated with sewage from which most of the organic matter has been removed by filtration through the other filter; the effect of this is to starve the organisms, which then break up and are washed out of the filter.

Research on Wastes

Another large part of the research on polluting liquors consists in developing methods of disposal of waste waters from industry. These liquors are as varied as industry itself and range from wastes containing so poisonous a substance as cyanide, to wastes containing milk from dairies and cheese factories. The first method of attack is always to try to reduce the losses of materials and the volume of waste waters discharged from a factory. In some industries, it is possible to alter the processes so that the waste waters can be re-used. An example of this is the retting of flax, for which factories were set up in Great Britain during the war. The waste liquors from the older processes of retting were dark-colored, foul-smelling and very polluting. They would have been difficult and expensive to purify and instead, a method known as "aerated retting" was developed, in which the waste flax was re-used in retting the next. Consequently, there were no discharges of liquor at the factories at which this method was adopted. The position is somewhat similar at factories which extract sugar from sugar beet.

It has been estimated that the waste waters from each of the larger factories in Great Britain, if discharged without treatment, would be as polluting as the sewage from a town of about 300,000 people. Treatment of such a liquor would be very costly and the situation has been met by altering the processes in the factory so that the various waste waters are treated by cooling, sedimentation, and screening, and are returned for re-use in the factory.

With the development of new industries, many countries are finding, as Great Britain did in the nineteenth century, that water is a very important raw material and that constant attention is necessary if adequate supplies are to be maintained.

*One of a series of talks broadcast by the British Broadcasting Corporation.

FOURTH INDUSTRIAL WASTE CONFERENCE AT PURDUE

Outstanding Meeting Draws Record Attendance of 325

THE Fourth Industrial Waste Conference at Purdue University was held on September 21 and 22 at the Memorial Union Building of the University in Lafayette, Ind. These conferences, which are held approximately annually, have become, in the short space of four years, the outstanding conference on industrial waste treatment in the country.

Gen. Chair.
D. E. Bloodgood
Prof. San. Engr.
Civ. Engr. School
Purdue Univ.

This year a record attendance of 325 registered for the meeting. Of those in attendance, sales representatives of manufacturers made up but a small percentage of the total registration. This fact contrasts with attendance at most water and sewage works associations meetings where sales representatives sometimes account for fifty per cent or more of the attendance.

Although the meeting was held primarily for the benefit of industry in Indiana, it drew attendants from twenty-five states and most of those in attendance were technical representatives of industry or representatives of state health departments interested in industrial waste treatment.

Under the direction of DON E. BLOODGOOD, Prof. of San. Eng., Purdue Univ., the program this year, as in the past, was one of considerable interest to sanitary engineers generally and of particular interest to persons engaged in special manufacturing processes.

The conference was sponsored by the School of Engineering of Purdue, the Technical Extension Division and the Indiana State Board of Health. Cooperating in the sponsorship were the Indiana Stream Pollution Control Board, Indiana Conservation Dept., Chamber of Commerce, Indiana Manufacturers' Assoc., Dairy Products Assoc., Canners' Assoc., Brewers' Assoc. of the State, the Indiana Sewage Works Assoc., and the Indiana Section of A.W.W.A.

In addition to the opening welcome to Purdue by Prof. R. B. Wiley, Head of the Dept. of Civil Engineering of Purdue University, the evening banquet was addressed by Stuart K. Holcombe, Head Football Coach, Purdue University. Mr. Holcombe spoke on Purdue's prospects in the fall season and particularly in the Notre Dame game which followed on the week end.

The luncheon session on the second day was presided over by Joseph L. Quinn, Assistant to the President of Holman & Co., Terre Haute, Ind., and Vice Chairman of the Ohio River Valley Compact Commission.

To offset the serious aspect of the meeting, at the luncheon session George E. (Doc) Symons, Assoc. Editor, *Water & Sewage Works*, New York City, spoke in the lighter vein and presented one of his verbal columns, "Here and There with Doc Symons".

GENERAL SESSION

The first day was given over to a general session at which papers of wide interest were presented to the audience. During the second day, group meetings were held for persons interested in specific types of waste and waste treatment problems.

Paper Waste in T.V.A. Region

F. W. Kittrell, Chief, Stream Sanitation Staff, Health and Safety Dept., Tennessee Valley Authority, Knoxville, Tenn., spoke on "PULP AND PAPER WASTE IN THE TENNESSEE VALEY." After outlining the extent of pollution from nine mills in the region, Mr. Kittrell stated that the total population equivalent to the waste of these mills was 1,225,000 persons. The sewage contributing population in the area is less than 1,000,000. At the present time four of the nine mills have instituted waste treatment which has reduced by 40 per cent the overall pollution load. Sewage treatment in the area has been negligible.

One of the difficulties of the problem is that even though the waste is treated to remove a large proportion of its B.O.D. load, there still remains a considerable color in the waste and when this color reaches the streams it causes the streams to become black. The public, therefore, refuses to believe that any improvement has been obtained. This color may be iron tannate.

The greatest improvement was obtained by the Champion Fiber Co. in North Carolina where changes in processes, recovery, and recirculation reduced the population equivalent by 360,000. Other plants have made smaller reductions.

Host
Ralph B. Wiley
Head
Civ. Engr. School
Purdue Univ.

Mr. Kittrell told of one problem on a small stream where a water supply was affected by waste discharged some distance below it. This stream discharges into the reservoir and because of the different temperature of the waste and the water from this stream there is actually an interchange of water because of the difference in densities, the waste actually backing up in the stream and displacing the less dense water.

Industrial Waste Survey

"MAKING A WASTE SURVEY FOR A LARGE INDUSTRIAL PLANT" was the title of the paper presented by William J. Eldridge, Supervisor, Water Treatment and Sewage Disposal, E. I. du Pont de Nemours & Co., Old Hickory, Tenn. Mr. Eldridge introduced his topic with a statement that the laggards in industry might as well understand now that waste abatement is here and furthermore that the cost of waste treatment must be considered part of the production cost of any product.

Before a waste survey is made, the company must set a policy and let all workers know what is planned. There must also be a top man in authority and an ample provision of money. Usually management cannot realize the extent of the problem and it is the head supervisor's job to see that the program of technological approach is explained to management.

There are two rules to be followed in the matter of waste surveys. The first is that there shall be no new wastes from new processes or expansion, and secondly that old wastes shall be reduced.

Mr. Eldridge offered the following items as essential to a proper program. (1) Good housekeeping; (2) treat waste with consideration being given

U.S.P.H.S.
Carl E. Schwob
San. Engr. Dir.
Water Poll. Cont.
Washington, D.C.

T.V.A.
F. W. Kittrell
Chief
Str. San. Sect.
Knoxville, Tenn.

to the degree of treatment necessary; (3) pick a good man to head the work; (4) provide necessary funds; (5) know the cost of production, profit margin, etc,; (6) analyze the materials in the process, those consumed in process, and those appearing in the waste, and determine a materials balance; (7) develop a system of records to give information on the status of the program; (8) provide facilities for collecting samples; (9) analyze samples; (10) survey receiving streams; and (11) develop publicity to inform plant management and operating and technical groups within the company.

Mr. Eldridge recommends that meetings be held at which the management, technical, engineering, and operating groups are present, where movies are shown, and talks are given to make the entire personnel realize the importance of pollution abatement.

The speaker concluded with a statement that the waste supervisor in any industrial plant should become acquainted with the stream pollution board in his state and should not only give cooperation but get cooperation. He also believes that there should be a free exchange on methods of waste treatment as far as possible between industries and that industrial waste representatives should attend meetings of sewage and industrial waste associations.

In the question period which followed, CLARENCE W. KLASSEN, Chief San. Eng. of Illinois, asked about the attitude of industry towards releasing operating reports on waste treatment processes in industry to state agencies. Mr. Eldridge said he saw no objection to release of such, although sometimes the legal department of an industry does object.

On the matter of how far cooperation can be expected between a state and an industry, Mr. Klassen said that in Illinois the State Dept. of Health's technical staff would make a study of an industry and make a report to the industry. The State Department, however, desires monthly operating reports and usually gets them although sometimes the industry does not want to give information that might incriminate them as a stream polluter. Klassen points out that streams are public property and the public has a right to know how that property is being used. Some industries don't want to tell what they have accomplished.

CLAIR SAWYER, Assoc. Prof. Sanitary Chemistry, Mass. Institute of Technology, said that too often the location of an industrial plant and its accompanying waste plant, if any, was the result of chamber of commerce action without due regard to any opinion that a state department of health might have.

KENNETH S. WATSON, State Water Commission, Charleston, West Va., said that in his state the industries were willing to report the load on streams and that the legal departments agreed that such reports were okay.

T. H. WISNIEWSKI, San Eng., State Board of Health, Madison, Wisc., stated that reports from the canning industry, of which they receive many, were received by the state as confidential reports and so filed. Most of the paper plants and canning industries which have treatment in Wisconsin make reports.

DR. H. A. TREBLER, Chem. Eng., National Dairy Research Lab., Baltimore, Md., stated that the milk industry had no secrets and told in their reports what happened. There was no unwillingness on their part to cooperate with state agencies and their lawyers had no objections to such cooperation.

In summing up the discussion, Professor Bloodgood said that state agencies should respect the feeling of industry towards production figures and not attempt to pry into the trade secrets of the company, but that such agencies should have the right to information on the waste treatment processes.

Federal Stream Pollution Control

Carl E. Schwob, San. Eng. Director in Charge, Water Pollution Control Section, U. S. Pub. Health Service, Washington, D. C., spoke on Public Law 845, "THE 1948 FEDERAL STREAM POLLUTION CONTROL LAW." Mr. Schwob pointed out the state's right in the matter of stream pollution control and the federal interest in the same matter. He said that it is written in the law that there must be a cooperative program between the states and the Federal Government. The law

Ohio River Compact

J. L. Quinn
Vice Chair.
Terre Haute
Indiana

C. W. Klassen
Exec. Comm.
Springfield
Illinois

provides for enforcement of stream pollution abatement in interstate waters and their tributaries.

While no funds have been appropriated for operation under this law, it is provided that there will be available $22,500,000 each year for loans for construction of treatment works and for preliminary plans. Most of this money will go to the smaller communities. There will also be a million dollar grant available to stream pollution agencies in the country to study industrial waste problems. Fundamentally, this law sets up a cooperative program between the Federal government, states, municipalities, and industries.

The program proposes that there be fourteen river basins set up in the country, each basin to have a local engineer of broad background in charge with an assistant engineer, biologist, draftsmen, and clerical help.

In the discussion of Mr. Schwob's paper, Mr. Ashton of the F.W.A. office in Chicago said that it is expected that the $22,500,000 available will meet about only one-fifth of the needs for three years. None of this money is retroactive for plans already made.

West Va. Program

K. S. Watson, Eng. in Charge, State Water Comm., Charleston, West Va., reviewed "INDUSTRIAL WASTE TREATMENT AND RECOVERY IN WEST VIRGINIA." The West Virginia Water Commission has had a three-phase program in operation for the past two and a half years. The first phase is the stream definition. The second phase will be to aid municipalities to provide sewage treatment. The third phase will be to aid industry. Stream zoning is now being carried on. Two streams, the Potomac and Kanawha Rivers, have been studied and zoned. These two represent 49 per cent of the drainage area of the state. Four zones are set up in each stream and the bases for zoning

Industrial Surveys
W. J. Eldridge
Supervisor
Water & Sewage
Du Pont
Old Hickory, Tenn.

Standard Methods
W. D. Hatfield
Superintendent
Sanitary Dist.
Decatur
Illinois

are public water supply, fish habitat, and recreational purposes.

There are a number of serious waste problems in West Virginia and Mr. Watson thinks that the first approach is recovery in some of these worst offenders. Laboratory studies should follow and then treatment of the waste with sewage should be considered.

The attack on the problem differs for different industries. For new industries, plans must be submitted and receive a certificate of approval of waste treatment before the industrial plant may be built. Other industries already in existence are studied and a feasible approach to the solution of the problem worked out for them. Mr. Watson mentioned in particular a tannery waste where the acid and alkaline wastes were combined and the spent waste lagooned before being discharged to the stream. In another case of by-product coke waste, the dephenolizing of ammonia liquor was recommended. In some coal washeries, closed systems are used to solve the problem.

Mr. Watson concluded with the statement that in his state all industrial plants were requested to report the effluent load from the waste treatment plant or from the sewers.

Ohio River Compact

In the absence of Hudson Biery, Chairman of the Ohio River Valley Compact Commission, Cincinnati, O.; C. W. KLASSEN, Chief San. Eng. of Springfield, Ill., and a Commissioner on the Compact from the State of Illinois, explained the "PLANS FOR THE OHIO RIVER COMPACT COMMISSION."

Mr. Klassen reviewed the history of the Compact with its early beginning in 1936, culminating in the signing of the compact by eight states on June 30, 1948. This was the same day on which Public Law 845 was signed.

The provisions of the Compact were to set up a Commission and to set up standards for the Ohio River or its tributaries between states or interstate. One of these standards is that 45 per cent of the suspended solids in industrial wastes and domestic sewage must be removed. There has been a technical committee set up within the Compact, but the Commission expects to look to the states to set the industrial waste pollution standards. The Compact provides for hearings and orders, but it is not expected that there will be a survey.

By-laws have been set up by a committee of the Commission and at the present time a three-man committee is reviewing candidates for the position of Engineer-Director to take charge of the work of the Commission. It is expected that the Ohio River Compact will work in close cooperation with the U. S. Public Health Service under the new Public Law 845.

GROUP MEETINGS

On the second day of the meeting the sessions were divided into group meetings dealing with seven different topics including dairy wastes, fermentation process wastes, food processing wastes, laboratory tests, metal wastes, oil wastes and miscellaneous.

While many persons would like to have attended more than one session, and there was some interference with that desire, it is felt that the group meetings served the best interest of the most persons. The wide interest shown is evidenced by the fact that whereas there were expected to be 30 in attendance at the dairy wastes and food processing wastes sessions, and 45 at the laboratory tests group, actually 58 showed up in the dairy group, 45 in food processing, and 60 in laboratory tests. Because these group meetings were held concurrently, it was impossible to report all of the 36 papers. The fact that a paper is not reported does not mean it has any less value than those reported but only that arrangements could not be made to have it reported.

Food Processing Waste

The food processing group heard papers on grease recovery from meat packing, anaerobic treatment of tomato and pumpkin waste, slaughter house waste, and nitrate treatment of lagoons.

A. H. Beard, Jr., San. Eng., Headman, Ferguson & Carollo, Tucson, Ariz., presented a paper on "DESIGN OF A GREASE RECOVERY PLANT FOR A MEAT PACKER." This plant is Kingdon & Co., Indianapolis, Ind., and

Oil Wastes
W. E. Howland
Prof. San. Engr.
Purdue Univ.
W. Lafayete, Ind.

Cyanide
B. A. Poole
Director
Bur. Env. San.
Indianapolis, Ind.

Mr. Beard reviewed the source of waste from the meat packing plant, giving total amounts of grease to be expected from different processes, and then proceeded to describe the basis of design which consists of a two-stage treatment, the first of which separates grease and the second consisting of aeration floc settling for process wastes. While the plant is not yet constructed, it is expected to cost $85,000, but will return an estimated net of $64,850 after operating costs of $19,000 a year. This return is based on an estimated recovery of 5590 lb. per day at a sale value of five cents a pound.

Robert E. Stiemke, Prof. San. Engineering, Pennsylvania State College, State College, Pa., described the "DISPOSAL OF WASTES FROM SMALL ABATTOIRS." Prof. Stiemke stated that 30 to 35 per cent of all the nation's slaughtering is done in small establishments which have a capacity of less than 40 hog units per day. (A hog unit means one hog, calf or lamb, and a steer or beef equals two and one-half hog units.) Some small slaughter houses discharge to city sewers but most do not, and the waste from these plants has a B.O.D. population equivalent of 18 per hog unit.

To study the treatment of these wastes a pilot plant was constructed at the penitentiary near State College, Pa. Test results are not complete but trends have been noted. The plant kills 6 to 20 hog units a day. Prof. Stiemke listed certain factors of fundamental importance to the construction of such a plant. These factors are:

1. First cost of construction must be low.
2. Process must be simple and fool proof.
3. Mechanical equipment must be at a minimum.
4. Operational duties should be simple and rapid.
5. Visible results of treatment should be encouraging to the operator.

Group Presiders

Fermentation
H. C. Feightner
Exec. Dir.
Ind. Brewers Assn.
Indianapolis

Foods
A. F. Dreyer
Secretary
Ind. Canners Assn.
Indianapolis

Keeping these factors in mind, three types of treatment have been studied: trickling filters, sand filters, and chemical treatment. (Activated sludge treatment is too complex.) Volume of waste treated varies from 500 to 2500 gal. per day. (Beef paunch manure is not included.)

Trickling filter results have been relatively poor because the intervals between slaughtering are too great and food supply to the biological slimes is not sufficient between times to maintain biological life.

Data on the sand filter operation are inconclusive, but perhaps where infrequent operation occurs the sand filter will have definite advantages over other biological treatment devices. Treatment by aeration was unsuccessful.

The most satisfactory treatment method to date has been with chemicals. Using calcium hypochlorite and filter alum, a B.O.D. reduction of 96 per cent was obtained. High test hypochlorite (70 per cent) was used at a rate of 0.2 lb. available chlorine per hog unit, and 3 to 5 lb. of filter alum were used per 1000 gal. of waste.

It is estimated that costs of operation would be as follows: With $Ca(OCl)_2$ — 12.5 cents per hog unit. Using chlorinated lime (bleaching powder) the cost would be 7.5 cents per hog unit.

(The following three papers were reported by T. F. Wisniewski, Sr. Asst. San. Engr., Wisc. State Bd. of Health.)

"Nitrate Treatment of Lagoons" was the title of the paper presented by H. H. Young, Chief Engr., Stokely Foods, Inc., Indianapolis, Ind. This corporation has installed 16 cannery waste disposal lagoons at plants in Michigan, Wisconsin and Indiana. Odors have been successfully controlled at some lagoons by use of sodium nitrate but difficulty has been encountered at other locations. It appears that engineering services are essential to the development of properly constructed lagoons which should be designed to hold all of the season's wastes plus the hold-over of one-fourth of the wastes from the previous season. Islands in lagoons should be eliminated and weed growth controlled or prevented. Fly and mosquito control can be accomplished by application of DDT at regular intervals. Regular inspection is necessary in order to prevent accidental drainage due to boring into dikes by muskrats. Adequate maintenance and repair of dikes and continuous daily application of sodium nitrate are essential to the successful operation of waste disposal lagoons.

R. A. Canham, San. Engr., National Canners Assn., Washington, D.C., spoke about a "Pilot Plant for Anaerobic Treatment of Tomato Waste."

An existing 3,600-gallon concrete tank at a cannery has been equipped with stirring equipment and a gas-collecting hood for use as an unheated digester for effluent from a vibrating screen. On 10 day detention a 68.8 per cent reduction in 5 Day B.O.D. was accomplished in the digester with an overall reduction through digester and final clarifier of 44 per cent. On 7½ day detention the reduction of 5 Day B.O.D. in the digester amounted to 73.6 per cent with an overall reduction of 48.7 per cent.

The objective of the study is to determine the feasibility of anaerobic digestion of tomato wastes in lagoons in order to produce an effluent satisfactory for discharge to a treatment plant or receiving stream and eliminate necessity for construction of large lagoons to hold all of the wastes produced in one season.

The pH ranged from 5.3 in the raw waste to 6.7 in digester effluent and 6.6 in final effluent. Digestion without production of objectionable odors was occurring at temperatures of 72 to 74 degrees Fahrenheit. In one run raw 5 Day B.O.D. averaged 957 ppm. and the effluent 5 Day B.O.D. averaged 418 ppm.

"Food Processing Waste Treatment in Wisconsin" was discussed by T. F. Wisniewski, Sr. Asst. San. Eng., Wisconsin State Board of Health, Madison, Wisc. The Wisconsin State Board of Health has since 1925, with the cooperation of the National Canners Association and Wisconsin Canners Association, conducted studies of cannery waste treatment. These studies have led to the development of treatment and disposal processes effective in reducing stream pollution in Wisconsin with all of the 159 canning plants providing screening of wastes. In addition, 20 use chemical precipitation plants, 45 use waste disposal lagoons and 33 discharge screen effluent to municipal disposal plants. The process selected by the canner depends on local conditions.

Milk
H. A. Trebler
Chem. Engr.
Nat. Dairy Lab.
Baltimore

Oil
R. F. Weston
San. Engr.
Atlantic Ref. Co.
Philadelphia

Two bulletins "Methods of Treating Cannery Wastes" and "Cannery Waste Disposal Lagoons" have been published by the National Canners Association on completion of detailed studies. Research work is continuing on a cooperative basis.

Dairy Wastes

(The following four papers were reported by W. A. Hasfurther, Prin. San. Engr. Ill. State Dept. of Health, Springfield, Ill.)

"Anaerobic Digestion of Milk Wastes," by R. A. Spaulding, Grad. student, Purdue Univ., summed up his research. The results of digestion of milk solutions in 3 liter flasks, with feed regulated so detention was six days, were given. Solutions of Pet condensed milk and water, with 5-day B.O.D.'s ranging from 380 to 3300 ppm., were used. Five hundred ml. of solution were added daily, in a batch, for a six weeks' period covering each test. Temperature was maintained at 31° C. and the contents of

the flask were stirred 23 hours daily by means of a mechanically operated propeller.

It was reported that raw wastes with a 5-day B.O.D. of 3300 ppm. and volatile solids content of 3750 ppm. were reduced 99.5 per cent (to 15 ppm., B.O.D.) and 93 per cent (to 260 ppm. volatile solids), respectively. Data were collected at the end of a feeding period of three weeks. In all cases the effluent B.O.D. was less than 50 ppm. A brief period of aeration was stated to reduce the effluent B.O.D. by 50 per cent.

About 500 ml. of sludge was withdrawn every three weeks. Withdrawal was necessary because the sludge became bulky. Gas analyses were made, but the author had no results.

There was no tendency during the tests for the wastes to go sour. The pH after four weeks went as low as 6.4, with a volatile acid content of 200 ppm. The effluent had an odor similar to petroleum products, and this was dispelled by aeration.

It was found that batch daily feeding was preferable to continuous feed. An early run showed that after three weeks gas production became constant. The digestion units were seeded with digesting domestic sludge.

D. G. Neill, Plant Engineer, Belle Center Creamery & Cheese Co., Belle Center, Ohio, spoke on "Milk Waste Disposal Plants." This paper described the treatment experiences at Belle Center, Ohio.

The plant processes, during peak seasons, approximately 150,000 lb. of milk daily. Cheese is made and milk sugar is extracted from the whey. Raw wastes amount to approximately 40,000 gpd. with a B.O.D. as great as 1138 ppm.

An injunction against disposal of untreated wastes to a stream forced the company to build three disposal lagoons with capacities of 10, 2½, and 5 million gallons each. These presented a serious odor problem.

Before a disposal plant was designed a waste reduction campaign was inaugurated. By collecting milk can drip and pre-rinse, wash from the loading tank, cheese press liquor, by controlling overflow of whey and by training employees, waste volume and concentration were greatly reduced. Clean water was separated from the wastes and run directly to the creek.

A chemical precipitation, rapid filter type plant was first constructed, but this operated so poorly that at the end of a year it was converted into an activated sludge plant.

Condensate from vacuum pans and cheese plant wastes go to a 15,000 gallon sump with pre-aeration. Discharge is to a second sump with a metering box which regulates flow to each of the two aeration tanks. The aeration tanks are 13 ft. dia. by 12 ft. high, and each is divided into three compartments. Overflow is to two parallel clarifiers, 14 ft. dia. by 10 ft. deep. They have center inlets, peripheral overflows, and sludge scraper mechanisms. Sludge discharges by gravity to a 12 ft. dia. by 14 ft. high digester. Three blowers are available, each with capacity of 210 cfm. Normally, one blower is used for each aerator unit, including sludge return.

Sludge for return is settled in a 500 gal. thickener tank, the supernatant being returned to the raw waste sump, and sludge to the aerator.

Temperature in the digester is kept at 100° F. by direct steam. No sludge has been removed after one year's service. Gas is wasted.

The main problem is to regulate the feed to the disposal unit so that there will be an even loading. Extremely concentrated dumps had to be eliminated.

In August results of daily analyses showed the following: volume 45,000 gpd.; B.O.D.: raw 1110 ppm., final effluent 15 ppm., and effluent diluted with cooling water 2.1 ppm. In September results of tests showed the following: volume 33,000 gpd.; 5-day B.O.D.: raw 1138 ppm., final 15.5 ppm., and diluted 2.8 ppm.

"Operation of the Double Trickling Filter," was the title of the paper by Dr. H. A. Trebler, Chem. Engr., Nat. Dairy Res. Labs., Baltimore, Md. Dr. Trebler explained that the two-stage high rate filter gave better results than a single-stage and when combined into a single unit cost very little more. Four plants with this type unit are in operation, using a 5:1 recirculation and all show efficiencies greater than 90 per cent. In milk plant design, construction costs are also reduced by building for a fifteen year life and eliminating items relating to improved appearance.

The construction and operation of the dual clarifier and double filter were explained. The clarifier was a single circular tank with a division wall in the center, for a primary and secondary settling unit. The division wall only extends to the top of the sludge section, and a sludge scraper is common to both sides. Flow is equalized, or a slight excess is used in the secondary side so that wastes from the primary side do not enter the secondary.

The double filter is a single bed of rock with the dosing arms arranged to apply primary wastes to the inner portion and secondary wastes to the outer ring.

On the basis of a raw waste loading of one lb. B.O.D. per cu. yd. of filter media per day, the effluent of a plant can be expected to have a B.O.D. of 60 ppm. At filter loadings of 26 lb. B.O.D. per cu. yd. per day a removal of 9½ lb. was obtained.

Slaughterhouse
R. E. Stiemke
Prof. San. Engr.
Penn State
State College, Pa.

Foods
T. F. Wisniewski
San. Engr.
State Bd. H'lth
Madison, Wis.

Oil
C. W. Hathaway
Metall. Dept.
Chevrolet
Detroit, Mich.

"A Milk Waste Treatment Plant of Unusual Design," was the subject presented by Max L. Barrett, San. Engr., Ind. State Bd. of Health, Ft. Wayne, Ind.

The milk plant is a receiving station with a present daily intake ranging from 70,000 to 200,000 lb. milk daily. The treatment plant, completed in 1947, was designed on the basis of a milk intake of 60,000 lb. of milk daily, and 15,000 gal. of waste at a 5-day B.O.D. of 750 ppm.

The treatment design was for batch operation. Wastes discharged through a grease trap to a holding tank, trickling filter and settling tank system in which they were to be recirculated for 24 hours. Then they were to be discharged to a second holding tank, trickling filter, settling tank unit for another 24-hour recirculating period before being discharged.

The holding tanks have capacities of 8000 gal. each, the filters are 22 ft. dia. by 6½ ft. deep, each, and the settling tanks on the basis of the filter dosing pump capacity had a retention

of only ten minutes. Sludge is pumped to trucks and hauled away.

From the start odors were noted and a poor effluent was obtained. Filter dosing rate was decreased and settling tank retention increased by reducing the filter pump capacity approximately two thirds, but little improvement was obtained.

Results of a 48-hour test when the plant handled 154,000 lb. of milk showed for the raw waste: volume 21,000 gal.; raw B.O.D. 950 ppm.; raw total solids 200 ppm.; and final B.O.D. 260 ppm. Reduction of B.O.D. was approximately 73 per cent. Dilution with cooling water and chlorination produced an effluent with a B.O.D. of 16 ppm. The plant is now planning to manufacture cheese and butter, thereby increasing wastes which will require redesign of the plant.

(The following paper was reported by A. Paul Troemper, Prin. San. Engr., Ill. State Dept. of Health, Springfield, Ill.)

The paper by W. Scott Johnson, Dir., Sect. on Envir. Sanit., Div. of Health of Missouri, Jefferson City, Mo., described a straight aeration type plant for cheese plant wastes at Mansfield, Missouri. The title of the paper was "Aeration Plant for Milk Waste Disposal." The treatment process consists of two grease traps in series, a wet well, pump, aeration tank, and settling well. The plant is simple and inexpensive to construct, consisting of 10,000 gal. steel tank with wood baffles and a small building to house the pump and blower. A detention period of approximately 24 hours was provided in the aeration tank. A float valve in the stilling well allows recirculation of plant effluent through the aerator during periods when no wastes are received at the treatment plant.

Eight cubic feet of air per gallon are applied to the wastes on the basis of the daily waste flow. Since the entire daily flow is received in a 12-hour period, actually 4 cubic feet of air per gallon are applied during the period of processing operations in the cheese plant. Air distribution is by means of ¼-inch nozzles in the air piping system.

Two tests were run of this treatment process, the first consisting of a 4-hour sampling period during the morning. In this test the reduction in B.O.D. through the treatment process was 40 per cent. A later test covering the entire working day indicated a B.O.D. reduction of 18 per cent. Dissolved oxygen in the wastes builds up during the night period and was found to be 6.0 ppm. after aerating over night. This disappeared by 7:30 a.m. Daily flow at the time of collecting the first series of samples was about 18,000 gal. per day and at the time of the second collection about 12,000 gal. per day. The cheese plant was receiving 50,000 to 60,000 lb. of milk daily during these studies.

Laboratory data indicate that a maximum of 50 per cent efficiency can be expected by straight aeration. This plant was designed for straight aeration, but with minor modifications could be operated as an activated sludge plant. While the data obtained are not conclusive for this type process, the author believes that it would appear to merit further investigation and experimentation in an effort to increase the process efficiency.

Fermentation Process Wastes

(The following five papers were reported by Eugene H. Trubnick, San. Chem., Anheuser-Busch, New Brunswick, N.J.)

Presided over by H. C. Feightner, Exec. Dir., Indiana Brewers' Assn., the section on Fermentation Process Wastes opened with a paper by Charles F. Niles, San. Engineer with the Howard K. Bell Co. of Lexington, Ky., on "Composting Spent Hops". Mr. Niles described experiments at Purdue, in which spent brewers' hops from the production of 1800 barrels of beer were composted for 90 days in batches 6 ft. in diameter by 4.6 ft. in height. With most of the decomposition occurring in the first 30 days, 90 days' composting resulted in 55 to 70 per cent loss in total weight accompanied by a 30 per cent loss in volume, an 80 per cent reduction in volatile matter and 40 to 50 per cent loss in nitrogen. Portions of the compost pile which were not exposed to the air remained green after 90 days; air penetrated to a point approximately 18 inches from the surface. The addition of manure to the pile was not necessary, and fly nuisance was kept under control.

Alex B. Davidson, San. Engineer with Schenley Distilleries, Inc., Cincinnati, reported results of investigations on the "Anaerobic Digestion of Distillery Wastes". Recovery of still slop solids, etc. in the dry-house results in removal of 98 per cent of the B.O.D. of distillery wastes; there remain, however, evaporator condensate and other dry-house wastes and miscellaneous plant wastes with a B.O.D. value of 200 to 1200 ppm., and containing 600 ppm. total solids, mostly dissolved, which must be treated before disposal. In both batch and continuous flow experiments, anaerobic digestion of these dilute wastes resulted in 90 to 95 per cent B.O.D. reduction in 22 to 48 hour detention periods. With aeration of digester effluents over-all B.O.D. reductions of 98 per cent were achieved. Gas production varied with the strength of the material and amounted to 625 ml. per gram of B.O.D. removed in 48 hours. In the continuous flow experiments, trouble was encountered in retaining sludge.

Cecelia Schuck, Prof. of Foods and Nutrition, Purdue University, presented the picture on "Yeast as a Human Food". Pointing out that food yeast can be grown in a matter of days, whereas grains for bread require weeks and months, and meat months and years, Miss Schuck reported that genetic control has resulted in control of taste in yeast strains, making possible the use of yeast as food without objectionable tastes. During the recent war over 200,000,000 pounds of yeast were used as human food in Germany. The addition of 1 to 3 per cent of non-fermentable food to cereal products enhances the biological value of the cereal proteins. Yeast-enriched bread remains fresh for at least a week.

Following the luncheon sessions, Eugene H. Trubnick, San. Chemist with Anheuser-Busch, Inc., Old Bridge, N. J., speaking on the "Treatment of Compressed Yeast Effluents", described experiments on the treatment of a material containing 1 to 2 per cent total solids, of which 70 to 80 per cent were volatile and 50 to 150 ppm., suspended; 2000 to 15,000 ppm. B.O.D. and 2000 to 2500 ppm. sulfate. Electrodialysis and activated sludge each produced maximum B.O.D. reductions of 40 per cent; treatment with various organic and inorganic materials showed no material precipitation or clarification.

Anaerobic digestion resulted in rapid and adequate purification with appreciable gas production if the sewage sludge used as seed was acclimatized gradually and if adequate contact was maintained between the seed sludge and the material to be treated. B.O.D. reductions as high as 94 per cent were attained; 24 hrs. detention, corresponding to a B.O.D. loading of 0.12 lb./cu. ft./day, resulted in 60 to 70 per cent B.O.D. reductions. The composition of the gas is similar to that produced by digesting sewage solids. Lime exerted no beneficial effect on normally progressing digestion mixtures. Trickling filter treatment resulted in 51 to 87 per cent B.O.D. reductions, decreasing with increased loadings. Greatest B.O.D. reduction occurred in the first 2 ft. of a 6-ft. filter. A high degree of nitrification

was noted, with the rate of nitrification accelerating progressively through the filter.

The final paper of the section was presented by E. C. Pattee, Consulting Chemical Engineer of Cincinnati, who gave a comprehensive survey of "RESEARCH IN THE DISPOSAL OF DISTILLERY WASTES", stressing developments in the use of by-products such as vegetable oils, amino acids, and solubles, and pointing out that even after recovery a residual material containing 400 to 700 ppm. B.O.D. remains to be treated.

Miscellany

(The following paper was reported by J. M. Brown, Chem. Engr., Lederle Laboratories, Pearl River, N.Y.)

C. H. P. Arbogast, Gen. Supervisor, Lederle Lab. Div., American Cyanamid Co., spoke on "INCINERATION OF WASTES FROM A LARGE PHARMACEUTICAL ESTABLISHMENT." The waste disposal problems at the Lederle Laboratories Div. of the company are intensified because the plant is situated on the watershed of the Hackensack Water Company. The incinerator used to render the solid wastes from this plant were described in this paper.

Combustible rubbish constitute a large percentage of the waste which includes contaminated manures, waste paper, glass, waste filter cakes, sewage sludge and garbage from the plant's cafeteria. The incinerator, a duo hearth type, built by the Nichols Engineering and Research Co., New York, New York, was built in 1945.

The dryer-incinerator, which it can be called, is provided with a drying hearth where sewage sludge from the industrial sewage treatment plant and filter cakes are rabbled on to the hearth before it is discharged to the combustion chamber. The lower chamber is equipped with a perforated cast iron cone with short tangential arms rotating slowly in the burning bed of rubbish, thus constantly agitating the mass and gradually pushing the larger pieces of ash outward over the grates. Air is admitted through the cone into the core of the burning mass and helps to insure complete combustion at all times. Ashes are removed from the conical bottom of the furnace through a sliding gate. Currently about 20,000 lb. of rubbish are burned daily. The temperature of the flue gases are maintained above 1725°F and no odor problems have been encountered.

The wastes from Lederle are comparable to a city of 25,000. The industrial waste is treated in the Laboratories pre-treatment plant before final discharge to the municipal plant.

LABORATORY TESTS

(The following papers were reported by D. Paul Rogers, Principal Chemist, State Dept. of Health, Harrisburg, Pa.)

M. Starr Nichols, Chemist of the Wisconsin State Laboratory of Hygiene, Madison, Wis., presided over the discussion group on Laboratory Tests. Attendance in this group was more than 75.

M. L. Riehl, Chief Chemist, State Dept. of Health, Columbus, Ohio, presented the "ANALYTICAL PROCEDURES FOR THE DETERMINATION OF METALS AFFECTING SEWAGE TREATMENT." Iron, copper, and zinc are most injurious of the metals, while nickel and chromium are suspected of being trouble makers.

Yeast
E. H. Trubnick
San. Chem.
Anheuser-Busch
New Brunswick, N.J.

Pharmaceutical
C. H. P. Arbogast
Gen. Superv.
Lederle Labs.
Pearl River, N.Y.

In the determination for *copper* the carbamate method is recommended. The sample is adjusted to pH 9.2 with ammonium hydroxide. A carbamate reagent develops a copper color which is extracted by means of carbon tetrachloride and compared with standards. Iron, manganese, and nickel interfere with the test.

Dimethylglyoxime reagent is recommended for the *nickel* determination, either colorimetrically or gravimetrically. In the colorimetric method, the developed color is extracted with chloroform and compared with standards within 15 minutes.

The diphenylcarbazide method for *chromium* may be used with certain precautions. Chlorides, nickel and iron show signs of interference, and the chromium must be in the hexavalent form. This method consumes time and is not considered easy. Iron in the sample needs to be removed and copper is to be tied up with sodium thiosulfate.

Cadmium is determined by the dithizone reagent, extracting the color with carbon tetrachloride, treating with solution of sodium hydroxide and comparing it with its standards. *Cyanide* is determined colorimetrically after a pink color is developed with phenolphthalin in solution. Cyanide, while not considered to be metallic, oxidizes a solution of phenolphthalin to phenolphthalein, which develops a pink color in an alkaline KOH solution. These methods are being developed for use by sewage plant operators.

C. C. Ruchhoft, Principal Chemist, U. S. Public Health Service, Cincinnati, Ohio, presented a paper on "THE DETERMINATIONS OF B.O.D. ON INDUSTRIAL WASTES." The author reviewed the bio-assay of organic matter that can be stabilized in a water or liquid state, Franklin (1807), Adeny in England, Spita (1900) in Germany, U.S. Institute (1910) in Columbus, Streeter (1911-12) in the Potomac Survey, Streeter and Phelps (1914), Theriault and Hommon (1917) have employed the oxygen in water for various uses, but it was only as early as 1917 when it was applied to the stabilization of organic material in domestic sewage.

The determination for B.O.D. which is the amount of oxygen required to stabilize organic matter in solution, is very much the same today as it was originally. The factors of pH which range from 5.0 to 8.5, of temperature at 20°C, and of time of 5 days for incubation, remain the same. The mineral constituents in some cases were in need of some additional nutrients and so a mineralized buffered dilution water with nitrogen and phosphorus was developed which is still used today with very good results. A mixed strain of organisms for seeding appears to give more reproducible results. Copper, phenol, and cyanides are very toxic to the organisms and should be counteracted.

Questions were asked and discussions took place on the importance of proper seeding to get reproducible results, of clean glassware, of sealing bottles, of rate of deoxygenation for industrial wastes, and of determining of the B.O.D. for any sample from the B.O.D. values of the various concentrations used in the test. A lively discussion was held on this latter subject. It was pointed out that some chemists still report the highest B.O.D. value obtained, some the lowest result, some analytical and some research laboratories report all the values obtained from the concentrations, some take the average from 20 to 80 per cent depletion of the dissolved oxygen during incubation, and some of the chemists, who are being obliged to make B.O.D. determina-

tions through the anti-stream pollution programs, are at a loss to know just what to do.

M. G. Mellon, Professor of Analytical Chemistry, Purdue University, West Lafayette, Ind., in his discussion of "COLORIMETRIC DETERMINATIONS" presented some of the latest ideas along the lines of polarography and absorptimetry. Importance was given to the selection and the preparation of the sample. The desired constituent should be separated by using as much knowledge of chemistry as possible through (1) volatilization, (2) precipitation, (3) electrodeposits, and (4) extractions. Measurements should be made through a specific property of a color system by means of color instruments—stimulimeters, comparimeters, and absorptimeters. Desirable color solutions are (1) self colored, (2) intensely colored, (3) stable, (4) unaffected by pH change, (5) between 500-600 mu., and (6) of low temperature coefficient.

Color reactions should be rapid, produced by colorless reagent, consist of stoichiometric reactions, and be free of interference.

There are several inorganic reagents which produce color through oxidation, reduction, completion with cationic and anionic reactions, or recomplexation through decolorization. Organic reagents occur in the development of color through salt formation, or coupling.

Selective filters are used extensively in absorptive characteristics of solutions. The spectrophotometer is used for making a calibration curve through the transmittancy and the log of the concentration.

W. D. Hatfield, Superintendent, Sewage Treatment Plant, Decatur, Illinois, discussed "SPECIAL TESTS FOR INDUSTRIAL WASTES." A number of problems in industrial wastes were presented to show that a big saving to industry may be had through cooperation. Qualitative spot plate tests were made prior to making a more complete test for oxygen consumed by permanganate. Chlorine demand tests also were of benefit in helping solve some of the problems in reducing losses of manufacturing. Beta-naphthol and sulfuric acid test for sugars were used to an advantage in a number of cases in which large losses were kept to a minimum. These non-standard methods were used for rapid tests on industrial wastes in order to prevent losses by industry.

Florida Public Health Engineering Conference

The First Annual Florida Public Health Engineering Conference was held at Gainesville, Fla., on November 12 and 13. The subject was Stream Sanitation and the meeting was sponsored by the Civil Engineering Section of the Engineering and Industrial Experiment Station of the College of Engineering, University of Florida.

The stated objective of the meeting was to bring together all groups interested in stream sanitation and to discuss existing and potential stream pollution problems with the view of arriving at a proper approach to the problems in Florida.

Included in the list of those appearing on the program were C. D. Williams, Head Prof. of Civil Eng., Univ. of Florida; Earl B. Phelps, Prof. of Sanitary Science, Univ. of Florida; David B. Lee, Chief Sanitary Engr., Fla. State Board of Health; Dr. A. P. Black, Vice Pres. A.W.W.A. and Prof. of Chemistry, Univ. of Florida; Dr. Herman Gunter, Fla. State Geologist; Ralph G. Cooksey, Pres., Fla. Wildlife Federation; Wylie W. Gillespie, Cons. Engr., Jacksonville; Joe Williamson, Jr., Cons. Engr., Daytona Beach; Keith R. Chinn, City Mgr., West Palm Beach; G. R. Grantham, Asst. Prof. Sanitary Engineering, Univ. of Florida.

Others participating in the program were Dr. Ralph A. Morgan, Director, Ind. and Engr. Experiment Station, Univ. of Florida; Russell L. Winget, Exec. Secy., National Council for Stream Improvement, Inc.; Dr. L. G. McDowell, Res. Dir. Florida Citrus Commission; R. B. Fuller, Mgr., Fla. Phosphate Div., International Minerals & Chemical Corp.; Carl E. Schwob, Sanitary Engr., U. S. Public Health Service; L. L. Hedgepeth, Exec. Secy., Va. Water Control Board, Richmond, and J. E. Kiker, Assoc. Prof. of Public Health Eng., Univ. of Florida.

Holmquist Retires from N.Y. State Dept. of Health

Earl Devendorf to Succeed Him.

C. A. Holmquist

E. Devendorf

On Nov. 1, Charles A. Holmquist retired after forty years of service in the Division of Sanitary Engineering of the N. Y. State Dept. of Health; since 1921 he had been Director of the Division. Starting as Asst. San. Engr. in 1908, Mr. Holmquist has played a prominent part in the history of the N. Y. State Dept. of Health. Starting with only four engineers, two of whom were with him at his retirement, Mr. Holmquist built the organization until it was recognized throughout the world.

A graduate of the University of Rochester in 1902 and the Mass. Institute of Technology in 1906, Mr. Holmquist has served on the Interstate Sanitation Commission, the Interstate Commission of the Delaware River Basin, The Great Lakes and Upper Mississippi River Board, and the Ohio River Valley Sanitation Commission.

Mr. Holmquist is a Life Member of the American Water Works Assn., and was a charter member and a past president of the N. Y. State Sewage Works Assn., and a member of the International Assn. of Milk and Food Sanitarians.

To replace Mr. Holmquist, the State Commissioner of Health chose Earl Devendorf as Director of the Bureau of Environmental Sanitation. Mr. Devendorf came to the department more than 30 years ago from Schenectady, where he had been Asst. Engineer in Charge of the sewage treatment plant. In 1927, Devendorf was made Asst. Director of the Sanitary Engineering Division under Mr. Holmquist.

A graduate of Union College in 1912, with a Master of Science degree in 1916, Mr. Devendorf has held a number of important assignments in the field of sanitary engineering, among which is advisor of the Legislative Committee on Stream Pollution Abatement for N.Y. State.

Mr. Devendorf is a member of A.W.W.A. and received the Diven Medal in 1943 for his Mutual Aid Program Work, and the Fuller Award for service to the N. Y. Section. He is also a charter member of the N. Y. State Sewage Works Assn., a Fellow in A.P.H.A., a member of A.S.C.E., the N.Y.S. Soc. of Prof. Engrs., and a member of the Quarter-Century Operators' Club of the Fed. S.W.A.

THE OHIO RIVER COMPACT

And Other Drainage Basin Compacts in the United States

by

KENNETH S. WATSON

Executive Secretary-Engineer*

WEST VIRGINIA WATER COMMISSION

CHARLESTON, W. VA.

ON June 30, 1948, in a historic and colorful signing ceremony in Cincinnati, the fourth interstate pollution control compact in the United States went into effect. [1] This ceremony culminated the efforts of many men from the Ohio Basin states over a period of at least 30 years. The idea of an Interstate Pollution Control Commission for the Ohio probably had its inception earlier than did the preliminary thinking for most of the compacts which have been in effect for many years. The number of states involved, the individual thinking of each, and the variety of legislative procedures and meeting dates, however, made its ratification time-consuming. The consummation of this Compact as an active instrument of pollution control attests to the diligence, perseverance, and long-range thinking of the men from the various states who have for a long time been proponents of this measure.

The first concerted effort toward interstate action to regulate pollution was spurred on by the passage in 1908 of an Ohio law which specified that River Cities located in Ohio need not provide treatment until those in other states did likewise. [2] Under the leadership of Ohio, a meeting of representatives of the various Ohio River states was held in Wheeling, West Virginia, on May 18, 1909, to discuss stream pollution control. This effort came to an end in 1911 with no definite interstate pollution control steps being taken in the next decade.

The development of a by-product coke industry in the Ohio Basin under the impetus of World War I increased industrial pollution of the stream and again pointed out the need for an interstate effort to reduce pollution. The states rose to the challenge, and by 1928 Pennsylvania, Ohio, West Virginia, Kentucky, New York, Illinois, Maryland, Indiana, Tennessee, North Carolina, and Virginia had become parties to an informal interstate pollution control agreement. Under this agreement in

The Author

a span of five years, 19 by-product coke plants provided equipment to dephenolize their wastes being discharged into the Ohio River and its tributaries.

The droughts of 1930 and 1934 pointed up anew the critical pollution of the Ohio and were responsible for the banding together of the Health Commissioners and Sanitary Engineers from the various states into a permanent organization. These same droughts created a serious water supply problem in Cincinnati and enrolled the interest and support of progressive leaders of the Chamber of Commerce in the battle for interstate action against pollution. The interest and activity of this Cincinnati group and others resulted in the 74th Congress of the United States adopting in 1936 Public Resolution 104 authorizing the states in the Ohio Basin to negotiate an Interstate Compact for the control and abatement of stream pollution.

Table 1

RATIFICATION OF THE OHIO RIVER COMPACT

State	Date	Reservations
Ind.	March 4, 1939	None
W. Va.	March 11, 1939	Contingent on similar action by N. Y., Pa., Ohio, & Va.
Ohio	May 29, 1939	Contingent on similar action by N. Y., Pa., & W. Va.
N. Y.	June 8, 1939	None
Ill.	July 22, 1939	None
Ky.	March 16, 1940	None
Pa.	April 2, 1945	Contingent on similar action by N. Y., Ohio, & W. Va.
Va.	March 5, 1948	None

After many committee and subcommittee meetings of the duly appointed representatives of the various states, a suitable compact was drafted, modeled along lines similar to the Interstate Sanitation Compact (New York, New Jersey, Connecticut). The first state to ratify the Ohio River Compact was Indiana on March 4, 1939. [3] West Virginia was second to take such action on March 11, 1939. Three other states ratified the Compact in 1939 and one in 1940 (See Table I). Pennsylvania ratified in 1945 after a delay due to the war. Virginia, the eighth and final state which was tied into the original group by a West Virginia reservation, ratified the Compact on March 5, 1948.

In order to consider more exhaustively the philosophy of regulating stream pollution by interstate means so that the position and probable scope of action of the new Ohio River Commission can be more readily visualized, the Interstate Pollution Control Compacts and Agreements now in effect will be briefly reviewed in the next section of this paper.

Interstate Pollution Control Measures

The four pollution control compacts now in effect are operating with the concurrence of the United States Government since all have been approved by Congress. In addition to these formal pollution regulation efforts, the Interstate Commission on the Delaware River Basin which is in effect as a result of reciprocal legislative agreement and functions in a manner similar to a compact is for the purposes of this paper being considered in conjunction with the compacts. The features of this interstate agreement and the four compacts have been summarized in Table II.

As indicated in Table II, the Interstate Sanitation Commission and that on the Delaware are the oldest interstate pollution control efforts since they went into operation in 1936. [3,4] The Interstate Commission on the Potomac became effective five years later in 1941. [5] The New England Compact is the youngest interstate effort, with the exception of that on the Ohio, since it had its inception in 1947. [6] A review of these

*Member of Ohio Commission and Executive Committee Representative from West Virginia.

Table II

Interstate Pollution Control Compacts in Effect in the United States

September 1, 1948

	The Ohio River Valley Water Sanitation Commission	Interstate Commission on Potomac River Basin	Interstate Sanitation Commission	Interstate Commission on Delaware River Basin	New England Interstate Water Pollution Control Commission
Signatory States Names	8 Ind., W. Va., Pa., Ill., N. Y., Ohio, Ky., Va.	5 Md., W. Va., Va., Pa., Dist. of Columbia	3 N. Y., N. J., Conn.	4 Del., N. Y., Pa., N. J.	3 Conn., R.I., Mass. (Me., N.H., Vt., N.Y. eligible)
Effective Date	1948	1941	1936	1936	1947
Commissioners Each State	3	3	5	5	5
Square Miles Covered	154,880	14,500		13,000	13,926 (at present)
Population Affected	15,822,337	2,100,000	11,000,000	5,000,000	6,739,309 (at present)
Staff		Director, clerical staff of 2	Director, 9 Ass'ts & 2 part time	Exec. Sec.-Engr., 4 Asst. Engrs., Technicians	No permanent staff as yet
Authority	Issues orders regulating pollution	Co-ordinates, investigates, summarizes technical data, acts as advisory agency, promotes uniform legislation and practices	Substantially the same as Ohio River compact	Co-ordinates enactment of uniform state laws. Develops and proposes objectives. States exercise enforcement authority	Co-ordinates and advises. Adopts water standards, stream classification. Enforcement authority remains with states
Minimum Waste Requirements	Removal of not less than 45% of suspended solids	None specified in Compact. Commission directed to recommend standards	Two classes of treatment specified, depending upon zone of carrying stream	Waste specifications based on zone of carrying stream	None specified
Stream Zoning	None specified	Preliminary zoning complete	Class A and B zones specified in Compact	Establish 4 zones in Compact	Compact authorizes zoning. Tentative standards have been adopted
Special Features	Consent of Congress given in Compact for other Ohio River States to become members			Program effectuated by terms of reciprocal Legislative Agreements not requiring ratification by Congress	Compact does not pertain to single basin, but to all interstate waters among the various states

interstate instruments reveals that the enforcement authority has been left in the hands of the states except in the cases of the Ohio and Interstate Sanitation Commission. These two Commissions are authorized to issue orders against pollution offenders.

The Ohio Compact at present covers the greatest number of states, the greatest drainage area, and the largest population. When, and if all the eligible New England states join that compact, it will exceed from a population standpoint the one on the Ohio. Table II indicates that the four older interstate commissions are giving consideration to stream standards and zoning. [7,8,9] Table II indicates that at least 7 per cent of the nation's surface area and about 31 per cent of the population are covered by formal interstate pollution control commissions.

Information on three additional interstate pollution control instruments which are of a more informal nature than that in effect on the Delaware Basin has been summarized in Table III. These three agreements have no enforcement authority and none of them required the ratification of the United States Congress. [10,11,12] The agreements acknowledge that pollution control is an interstate problem and the signatory states agree to cooperate with each other in its regulation. The fact should probably be mentioned that a Tri-State Water Commission Compact authorized by the Federal Government was ratified by North Dakota, South Dakota and Minnesota in 1937. This Commission was set up to function as a nontechnical planning agency for flood and pollution control. It is understood that this commission has been inactive in recent years in pollution control matters.

It is interesting to note from Table I and II that New York is active in more interstate stream pollution control efforts than any other state. This state belongs to two interstate compacts and is eligible for membership in a third. New York is also a signatory state in two of the four interstate agreements. Pennsylvania is a very close second as a result of be-

Table III

Interstate Pollution Control Agreements in Effect in the United States

September 1, 1948

	Great Lakes Drainage Basin Sanitation Agreement	Upper Mississippi River Drainage Basin Sanitation Agreement	Interstate Sanitation Committee
Signatory States, No.	8	5	3
Signatory States, Names	Wis., Minn., Ill., Mich., Ohio, Pa., N. Y., Ind.	Minn., Iowa, Wis., Ill., Mo.	No. Dak., So. Dak., Minn.
Went into effect	1928	1935	Recently
Co-operating Agency at State Level	Department of Health and Pollution Control Agency	Department of Health through Sanitary Engineering Division	Departments of Health and Conservation Commission
Staff	None	None	None
Authority	Co-operative agreement; no enforcement authority	Co-operative agreement; no enforcement authority	Co-operative agreement; no enforcement authority
Minimum waste treatment requirements	Primary for sewage	None specified	25 ppm. B.O.D. 20 ppm. suspended solids
Stream zoning	None	None	None
Special features	Annual 2-day meetings only	Agreement outgrowth of interstate development between Minn. and Wis. in 1925	

longing to two of the four compacts and being a member state in two of the four agreements.

In considering interstate pollution control perhaps mention should be made of the Treaty between Great Britain and the United States [13] relating to boundary waters between the latter nation and the Dominion of Canada. An international joint commission has been functioning under this Treaty since 1912 and has as one of its objectives the regulation of pollution in international waters. Actual pollution investigations of the boundary waters were launched in 1946 under the Commissions Board of Technical Advisors. This board consists of 4 members from Canada and a similar number from the United States. This nation is represented by 2 officials from the United States Public Health Service, which is the agency doing the survey work, and a like number from the state of Michigan, for studying the Detroit area. This study has been completed and the study has shifted to the Niagara River. For this area, the Michigan representatives on the Technical Board are replaced by two representatives from the state of New York. The advisory board has prepared a statement of "objectives" including tentative wastes standards which should be met by industries and municipalities before discharging wastes into the waters in question.

Table IV

OHIO RIVER VALLEY WATER SANITATION COMPACT BASIC DATA FOR DETERMINING ANNUAL BUDGET*

State	Area Within Basin		Population in Basin		Weighted Average Based on Areas and Population
	(Sq. Miles)	(%)	(1940 Census)	(%)	(%)
1. Illinois	11,440	7.4	600,458	3.8	5.60
2. Indiana	29,135	18.8	2,503,450	15.8	17.30
3. Kentucky	39,375	25.4	2,790,756	17.6	21.50
4. New York	1,955	1.3	149,421	1.0	1.15
5. Ohio	29,570	19.1	4,126,594	26.1	22.60
6. Pennsylvania	15,620	10.1	3,418,605	21.6	15.85
7. Virginia	7,175	4.6	455,441	2.9	3.75
8. West Virginia	20,610	13.3	1,777,612	11.2	12.25
Totals	154,880	100.0	15,822,337	100.0	100.0

*Basic data from United States Public Health Service Report on Ohio River substantiated by information obtained by Mr F. H. Waring from the several member states of the Compact.

The Ohio River Compact and Commission

As indicated in Table II, the Ohio River Compact specifies that suffi-

The Ohio River Basin

(Drainage Area—203,900 sq. mi.—1940 Population—18,815,800)

cient treatment must be provided to remove at least 45 per cent of the suspended solids from domestic sewage [15]. This requirement means that all municipalities of consequential size located in the basin must provide at least primary sewage treatment. The wording of the Compact can probably be further construed to mean that industries contributing pollution of consequence must provide waste treatment at least equivalent to primary treatment.

The Compact further provides the Commission with authority to issue pollution control orders against offenders after an appropriate hearing has been held. A formula for breaking down the funds for financing the program of the Ohio River Valley Water Sanitation Commission into proportional contributions from each state is specified in the Compact. Each of the signatory states agrees to meet its portion of the budget by appropriating funds, one half of such amount to be prorated among the several states in proportion to their population within the basin and the other half to be prorated in proportion to their land area within the basin. Table IV indicates the basis on which the Commission's operating budget will be broken down among the states. It will be noticed from Table IV that Indiana, Kentucky, and Ohio are the three states with the greatest drainage area and Kentucky, Ohio, and Pennsylvania are the three with the greatest populations in the Ohio Basin. Funds have only been regularly appropriated by one of the states, but a request for operating funds will be made to the next session of the state legislatures. A preliminary budget is being raised at present to allow the Commission to inaugurate a program.

The Compact makes provision for Ohio River states other than those now signatory to become parties in this interstate effort. (Map I) The Commission has already agreed to extend an invitation to the other Ohio River states to become members of the Compact. The other states which probably would benefit most from the Compact are Tennessee and Alabama.

At the first meeting of the Commission, Hudson Biery of Cincinnati, who for a long time has spearheaded the drive for the ratification of the Compact, was elected its first Chairman. At the same meeting, Mr. J. L. Quinn of Indiana, was elected Vice Chairman and Mr. F. H. Waring of Ohio, Acting Secretary.

As a result of two meetings of the Commission and two meetings of the Executive Committee the following Committees have been appointed and are working on a framework around which the program of the New Commission will be built: By-laws, Policy, Budget, and Public Relations. An Engineering Committee has also been appointed consisting of the Chief Engineers of the Health Departments or other state regulatory agencies to consult with the Commission in the interest of assuring that the program devised will represent the best interests of the member states.

Through the efforts of the Chairman, office space for the Commission's staff has been leased at 410 First National Bank Building, Cincinnati, Ohio. A stenographer who will temporarily serve as office manager has been employed. The Chairman is at present handling necessary correspondence and other business until additional permanent personnel is employed by the Commission.

West Virginia

The West Virginia Water Commission views the Ohio River Valley Water Sanitation Commission as an agency to assure all of the states that each of the states will make a reasonable effort to reduce pollution and thus improve the critically contaminated Ohio River. Up to the present time most of the states, including West Virginia, [16] have insisted that the principal offenders install waste treatment facilities or begin steps in this direction. Since the pollution of this stream does not begin or stop at the state boundaries, however, efforts in the past could not make a marked improvement throughout the entire length of the basin. No state felt particularly justified in launching an all out clean-up program since it did not know exactly what action to expect from the other states. In signing the compact eight of the Ohio Basin states have committed themselves on minimum requirements and agreed to cooperate with each other in improving this important stream.

West Virginia industries and municipalities in the Ohio Basin which are working with the Water Commission in providing waste treatment should welcome the passage of the Compact. This action merely means that these contributors of pollution will not be imposed upon by the West Virginia pollution control program but their neighbors in adjacent states must meet similar requirements. The fact that all industries and municipalities contributing pollution must provide waste treatment will ultimately mean that the Ohio will be improved so it will more satisfactorily serve all its users.

Since the Water Commission Act provides enforcement authority for the provision of waste treatment, all problems in West Virginia which can not be solved cooperatively will be handled by this legal machinery. [17] The Compact does provide a higher authority which will serve to supplement the authority of the Water Commission should such augmentation be necessary. It seems apparent from the spirit of the Ohio River Compact that those industries and municipalities which are cooperating fully with the Water Commission will not be burdened by additional requirements originating in the Ohio River Valley Water Sanitation Commission.

Acknowledgment is hereby made to the Chief Engineers of all the interstate groups and a number of State Health Departments for their cooperation in supplying much of the information used in this paper.

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FED. SEW. WKS. ASSN. REPORT CONTINUED

Second Installment Reviews Technical Papers

THE PREVIOUS installment of this report reviewed the business activities of the 21st meeting of the Federation of Sewage Works Assns. held in Detroit Oct. 17-21. Also in that first report, which appeared in the December, 1948, issue, there appeared abstracts of three of the papers presented at that meeting. This section of the report covers the remaining papers.

Stream Pollution Indices

In discussing the subject of "INDICES OF STREAM POLLUTION," Don E. Bloodgood, Prof. of Sanitary Engineering, Purdue University, reviewed a number of court cases to show what had been considered legal definitions of stream pollution. While it is true that a higher court has reversed a lower one on the same evidence, and that the same court has in some instances reversed its own opinion on rehearing the same evidence, still the attitude of the courts toward what constitutes pollution can be assessed.

According to Prof. Bloodgood, the collection of information from the cases cited is but a small fraction of that needed to establish a basis for indices of stream pollution. Among those causes for court action apparent from the cases cited, Bloodgood listed the following:

1. Noxious and noisome slime on banks or beds of stream.

2. Wastes that cause foul odors, or odors themselves that are carried for two miles.

3. Deposition of offal, filth or noisome substances in streams.

4. Discharges of chemicals and other deleterious substances that kill fish, or that create noxious vapors, or provide breeding places for large numbers of flies or other insects.

5. Discharges of sewage making water so that cattle will not drink it.

6. Milky white wastes from a distillery.

7. Wastes that settle to the bottom of streams and decompose into black solid elements (sludge).

8. Small quantities of polluting substances.

9. Oil discharges changing the taste of water in a stream.

10. Dyes discoloring streams (extract of logwood).

11. Discharges of any of the following: Soap, soda ash, soda salts, blue vitriol, lead, arsenic, caustic soda, petroleum, methyl alcohol.

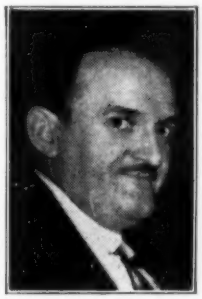
12. Discharges of wastes causing corrosion of piping, mine wastes that render water supplies unfit for human consumption, and salt water that ruins water supplies.

13. Discharges of wastes into the ground that contaminate ground or surface water supplies.

14. Waste discharges that cause irritation to the skin of man.

According to Bloodgood, the state laws governing pollution of streams in the several states are in general no more rigid than the precedents set up in the court cases he cited It appears that in general the court evidence gives backing to pollution laws similar to that of the State of Illinois, which was quoted as an example.

In the absence of Robert N. Clark, Chief Public Health Engineer, Tennessee Valley Authority, Chattanooga, Tenn., his prepared discussion of Bloodgood's paper was read by F. W. KITTRELL, Chief, Stream Sanitation Section, Tenn. Valley Authority, Knoxville, Tenn. Mr. Clark's paper emphasized the lack of concrete indices of pollution in court cases. For the layman such things as appearance, taste, and smell are the important factors, but scientifically these are not specific. What is needed is a better understanding between engineers and the public. Mr. Clark concluded with the statement that correction of stream pollution must not be based solely on the dollars and cents involved, but must also include the aesthetic values of the situation.



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Sewage Treatment Biology

Speaking on the "Biology of Sewage Treatment," James B. Lackey, Editor, The Blakiston Co., Philadelphia, Penna., said that the best complete sewage treatment is a combination of aerobic and anaerobic processes, but one at a time. While the flagellates, ciliates, and amoeba in aerobic treatment are well known to the biologist, there are few data available on anaerobic organisms.

While showing slides of various organisms, Mr. Lackey said that to obtain the best removal of B.O.D., a high population of mixed organisms is needed. Although there is still too little known about the biological processes in sewage treatment, one thing has been learned: to control unwanted filter flies, and snails, use DDT. No one knows now what will happen to biological slimes when and if radioactive wastes get into sewer systems.

In discussing this paper, GERARD R. ROHLICH, Assoc. Prof., College of

Engineering, University of Wisconsin, Madison, Wisc., quoted the work of Heukelekian at Rutgers, and Buswell at Illinois on the anaerobic methane processes. The role of bacteria in aerobic processes is fairly well known but information is lacking on the higher forms. From microscopic studies on activated sludge, evidence is available to show that bacteria have slight influence on the process but that protozoa are very important.

Activated Sludge Bulking

Under the title, "QUANTITATIVE RELATIONSHIPS IN THE ACTIVATED SLUDGE PROCESS," Leon S. Kraus, Chemist, The Greater Peoria Sanitary District, Peoria, Ill., said that bulking is a normal phenomenon, for it is just a variation in the volume of the sludge. In the continuously changing biological system and concentration of nutrients it is to be expected that such variations in volume of sludge will take place. Bulking is due to the precipitation of insolubles, bacteriological organisms, etc.

By means of slides, Mr. Kraus showed how he had reduced the phenomenon of bulking to mathematical equations which take into account such variables as time, concentration of food, etc. It is not bulking itself, which is the problem, but it is the control of bulking that is important.

The paper was discussed by EARNEST BOYCE, Chairman, Department of Civil Engineering, University of Michigan, Ann Arbor, Mich. Prof. Boyce said that sudden bulking may result from variations in many factors and in breakdown of the biologic workshop conditions. To function properly, activated sludge must contain biologically balanced populations capable of taking on changes in concentration of food substances. In considering the problem of bulking, there has often been a confusion in cause and effect, according to Prof. Boyce.

Sewage Treatment in Ontario

Dr. Albert E. Berry, Director, Sanitary Engineering Division, Ontario Department of Health, Toronto, Ont., presented a paper on "SEWAGE TREATMENT AND WASTE DISPOSAL IN ONTARIO." Dr. Berry's paper reviewed the extent of sewage treatment in the Province of Ontario, and the difference in operating conditions at the generally lower temperatures which exist in Canada. (Ed. Note: We regret that other commitments made it impossible for us to hear this paper and its discussion by Samuel A. Greeley and Kenneth V. Hill, of Greeley and Hansen, Engrs., Chicago, Ill.)

(The following papers were reported by Harry A. Faber, Research Chemist, The Chlorine Institute, New York, and Editorial Associate, *Water & Sewage Works.*)

K. V. Hill
Partner
Greeley & Hansen
Chicago, Ill.

G. A. Rohlich
Prof. San. Engr.
Univ. of Wis.
Madison, Wis.

E. Boyce
Chair. Civ. Engr.
Univ. of Mich.
Ann Arbor, Mich.

L. W. Van Kleeck
Prin. San Engr.
State H'lth Dept.
Hartford, Conn.

Discussors

H_2S Production

George S. Russell, President FSWA, presided over the Tuesday morning session in which three laboratory research studies of exceptional interest were described.

The first paper, titled "STUDIES OF THE MECHANISM OF HYDROGEN SULFIDE PRODUCTION," was presented by Rolf Eliassen, Professor of Sanitary Engineering, New York University. Co-authors of this paper were Austin N. Heller, Research Associate, Gerhard Kisch, Research Fellow, and Theodore Jaffe, Research Fellow, all of New York University.

It was pointed out that the production of hydrogen sulfide in sewage occurs through biochemical reactions of two types, depending upon the source of sulfur which is utilized. First, the mixed population of sewage organisms (such as the coliform group) consume sulfur-containing organic compounds. In the secondary production of sulfides, a vibrio reproduces in such numbers as to effectively reduce sulfates to sulfides. This vibrio *(Sporovibrio desulfuricans)* is enabled to multiply when the oxidation-reduction potential becomes lowered to the range minus 200 to minus 300 millivolts.

Studies demonstrate that emulsified chlorinated hydrocarbons (ortho-dichlorobenzene is one of these) can inhibit the initial production of hydrogen sulfide in sewage. This treatment keeps the sewage relatively fresh as it passes through the sewer system. A concentration of 1.0 ppm. of Cloroben emulsion may accomplish 75 per cent inhibition of sulfide production in normal domestic sewage for 18 hours at 37° C. A higher dose is not appreciably more effective.

Small doses of chlorinated hydrocarbons do not inhibit the formation of hydrogen sulfide from mineral sulfates. This mechanism must be controlled by removal of the sources of the vibrio, such as sewer slimes. However, the chlorinated hydrocarbons, when added to inhibit the initial production of sulfide in sewage, will remove slime accumulations and thus limit the secondary reactions. They are effective in this respect, also, because the lowering of the oxidation-reduction potential of sewage is retarded and the conditions required for vibrio growth are not reached as quickly.

The results of this study indicate small concentrations of Cloroben, as low as 0.25 ppm., to be markedly effective. There is little difference in the effect of concentration between 0.5 ppm. and 10.0 ppm. of this material. The study planned is a continuing one, and only the first part was reported in this paper.

LEROY W. VAN KLEECK, Principal Sanitary Engineer, Connecticut Dept. of Health, Hartford, discussed certain applications of hydrogen sulfide control. He mentioned early studies (1936) at Greenwich, Conn., in which ortho-dichlorobenzene *not* emulsified was added to stale sewage having a high chlorine demand. Because it was used too late in the treatment process, this application did not prove effective and indications were that it might adversely affect sludge digestion.

It has been found that when sewage effluent is discharged to salt water, the sulfate content is readily reduced to sulfide. Studies at Stamford, Conn., have shown prechlorination of the sewage materially reduces the rate of reduction under these conditions. Mr. Van Kleeck cited practical considerations which make the control of hydrogen sulfide desirable.

L. H. ENSLOW, Editor of *Water & Sewage Works,* and Consultant, The Chlorine Institute, New York, referred to his pioneer studies of sulfide

control. He considered a concentration of less than 1.0 ppm. of hydrogen sulfide to be no serious problem, but emphasized the rapidity with which the second type of sulfide formation (from sulfates) can occur.

Enslow emphasized the importance both of temperature in sulfate reduction, and of the slime growths above the flow of sewage in sewers. New studies, such as that presented by Eliassen, were commended for their indication that more specific chlorine compounds may be developed for sulfide control applications.

Oxygen and Bio-precipitation

The second paper of this session, "A System of Bio-Precipitation of Organic Matter from Sewage," was presented by Daniel A. Okun, Asst. Engr., Malcolm Pirnie Engineers, New York, formerly Teaching Fellow in Sanitary Engineering, Harvard University.

Mr. Okun reported on the possible use of low-cost oxygen (produced by air liquefaction and rectification), called "tonnage" oxygen, for the aerobic biological treatment of sewage. His investigation and development of this process, based on a method suggested by Malcolm Pirnie, has resulted in a new method termed "bio-precipitation."

[Ed. Note: The term "bio-precipitation" was used by Buswell and coworkers at the University of Illinois more than 20 years ago.]

As influent to the duplicate experimental units, well-settled raw domestic sewage was employed. Continuous flow of this influent was maintained downward through a tapered glass oxygenating tube, countercurrent to the upward movement of oxygen bubbles. The oxygenated sewage was discharged into the bottom of the precipitation unit which contained the suspended biological floc. Sewage thus flowed upward through the masses of floc, clarified and discharged at the top of the unit.

The maximum oxygen concentration obtainable in the sewage in the tube was about 35 ppm. Effluent was recirculated as discharged from the precipitation unit and was mixed with the raw sewage. Widening of the top of the precipitation unit, in a cone shape, provided decreasing upward velocity, which absorbed fluctuations in the condition of the floc suspension. A slow-speed stirring device was required to prevent short-circuiting of the sewage through channels in the floc blanket.

Operating results indicate that a smaller plant capacity is required in this oxygen process than in activated sludge treatment; that is, only about one-fourth the volume of aeration tanks necessary for the activated sludge process should give equivalent results. For "intermediate treatment" even less volume of aeration tanks would be required There should be no rising of sludge blanket, since the reduction of nitrites and nitrates does not occur. Air can be used for pre-oxygenation of sewage, instead of oxygen, at low loadings with no decrease in efficiency. However, higher recirculation rates are reported to be necessary and the sludge is somewhat difficult to control.

The results are of sufficient promise to warrant consideration of bio-precipitation, using low-cost tonnage oxygen, as a full scale means for sewage treatment. No comparative cost figures can be offered until data are available from a pilot plant installation. For a high degree of treatment, however, this new method appears to offer three to four-fold savings in plant requirements over those for the activated sludge process.

A prepared discussion of this paper was presented by Dr. F. W. Mohlman, Director of Laboratories, The Sanitary District of Chicago, who congratulated the author for his exceptional paper. It does appear that shorter detention periods would be possible in the bio-precipitation process because higher solids loading can be maintained when oxygen is used instead of air. However, Dr. Mohlman indicated the desirability of a larger amount of comparative data on air vs. oxygen.

Apparently, the greatest difference established is not so much the use of oxygen as it is the special apparatus, which may be translated into a radically different type of treatment plant. While practical difficulties will certainly be encountered, the original problems in the development of activated sludge treatment were not found insurmountable. Dr. Mohlman expressed the hope that a pilot plant investigation will soon be forthcoming.

Synthetic Detergents

The third paper of the session was presented by Dr. Willem Rudolfs, Chairman, Dept. of Sanitation, Agr. Expt. Sta., Rutgers University, who discussed "Effects of Synthetic Detergents on Sewage Treatment Processes." While the use of these surface-active agents is relatively small (approximately 9 per cent of the weight of soap production), it is showing a steady increase. Time available permitted the author to discuss only the practical aspects of this study.

These materials have less effect on the strength of sewage than soap. The synthetic detergents, however, lower the efficiency of settling—and with their increasing concentration more suspended matter remains in the effluent. Little effect will be noted on the volume of sludge produced.

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Dept. Health
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Prof. San. Engr.
Purdue Univ.
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R. Eliassen
Prof. San. Engr.
New York Univ.
New York City

L. S. Kraus
Chemist
Sanit. Dist.
Peoria, Ill.

Programmers

In general, the increase in B.O.D. will be due only to the slight increase in the amount of grease obtained. With the exception of a few compounds, no surface-active agents exhibit toxicity which would affect biological activity.

When sewage containing synthetic detergents is treated by the activated sludge process, their principal effect is to decrease the solids and to produce a considerable amount of foaming. These new materials are not of immediate concern, therefore, except where laundries provide a large proportion of industrial waste, and where soft water supplies are found. When the concentration of detergent reaches 50 to 100 ppm., foam several feet in depth may be produced in a sewage treatment plant.

FORUM ON INDUSTRIAL WASTES

The Tuesday afternoon session, with Dr. F. W. Mohlman presiding, was devoted to an Industrial Waste Forum. Dr. Mohlman commented on the special waste problems of the chemical industries, pointing out that these are being largely self-investi-

gated; the waste disposal problems can frequently be solved by eliminating the waste within the industry.

Chemical Wastes

According to V. L. KING, Technical Director, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., whose paper was titled "Effluents from Chemical Manufacturing in Bound Brook," progress in stream pollution correction has been too slow. He discussed, as an approach to solving the problem, the adoption of regulations which could be based on the characteristics of the particular waste and the particular stream involved.

Streams were viewed as reservoirs of both dissolved oxygen and acid neutralizing power. In order to utilize these characteristics, authorities exercising control over the stream must have records of the variations in stream quality. The amount of available dissolved oxygen could then be allocated to those industries discharging wastes and would thus define the degree of waste treatment required.

According to Mr. King, the commonly used yardstick of B.O.D. may not apply to chemical wastes. The complete neutralizing of acids has been found to give less effective destruction of coliform bacteria (as compared with reduction only to pH 4.0). Foam can be removed, where it is a problem, by proper skimming devices. He suggested a uniform rate of flow be maintained in streams, thereby utilizing the maximum dissolved oxygen and alkalinity available for waste treatment at all times.

RICHARD D. HOAK, Senior Fellow, Mellon Institute, University of Pittsburgh, in discussing Mr. King's paper, agreed that progress in stream pollution abatement frequently is hindered by enforcement of too stringent requirements concerning industrial waste effluents. A "stepwise" solution to this problem could prove more effective. He discussed the relation existing between toxicity of certain substances and the degree of dilution which may result in receiving bodies of water.

DON E. BLOODGOOD, Professor of Sanitary Engineering, Purdue University, called attention to administrative problems involved in allocating stream capacity amongst industrial competitors.

Dairy Waste

A paper on "DAIRY WASTE DISPOSAL" was presented by E. F. Eldridge, Chief Engineer, State of Washington Pollution Control Commission, Olympia, Washington.

Limiting his discussion to recent developments in this field, Mr. Eldridge referred particularly to a report on an industry-sponsored study. Both waste prevention and waste treatment are being investigated. Waste prevention, to be effective, must be a permanent remedy; it adds to salable products and reduces the problem of waste treatment.

At one milk receiving and cheese manufacturing plant, the original effluent B.O.D. of 250 to 1200 lb. per day has been reduced by preventive methods down to 150 to 500 lb. per day, and has provided a more uniform effluent quality. Such a study was advised as the first step of any program.

Regarding treatment of milk wastes by activated sludge treatment, it was noted that maintenance of 1 to 4 ppm. of dissolved oxygen in aeration units, and of a trace in clarifiers, is essential. Pilot plant studies indicate mixed liquor solids concentrations of 5000 to 8000 ppm. to be desirable (settling to 300 ml. in 1 hour is about the optimum). In one plant, an average B.O.D. influent of 243 lb. per day has been reduced to 11 lb. in the effluent. Pilot plant studies of treatment by aeration without return sludge shows a B.O.D. reduction of about 40 to 50 per cent may be accomplished in an 18 hour detention period.

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Prof. of Bact.
Mich. State Coll.
East Lansing, Mich.

H. A. Trebler
Chem. Engr.
Nat. Dairy Res.
Balto., Md.

T. J. Powers
Waste Disp. Div.
Dow Chem. Co.
Midland, Mich.

More Discussors

Chemical Manufacturing Wastes

"WASTES FROM CHEMICAL MANUFACTURING" was the title of a paper presented by Raymond W. Hess, head of Pollution Research and Operating Improvements, National Aniline Division, Allied Chemical and Dye Corporation, Buffalo, N. Y. He stated that several pounds of waste may frequently be produced for each pound of usable products. Sometimes there exists no known or even visualized method of treating chemical wastes.

For evaluating the pollution load imposed by chemical wastes, methods of chemical analysis are frequently inadequate. The relation between B.O.D. and chemical oxidation is not a constant one. Toxicity studies should be related to the mixtures in which various wastes actually occur, and to the section of the stream where aquatic life is expected to exist. Where a charge for waste treatment includes the chlorine demand as a basis, it was recommended that the chlorine demand should be determined when the waste reaches the sewage treatment plant (rather than when the waste is discharged) and in the dilution of the waste reaching the treatment plant (since the mixture may materially reduce the actual chlorine demand).

Dr. Hess called attention to the Pollution Control Sub-Committee of the Manufacturing Chemists' Assn. (The MCA). This group is studying various wastes and is organized to advance understanding of the problem within chemical industry. Progress is being made in the exchange of information, in the establishment of fellowships to investigate the problem, and in the integration of industrial pollution studies with those of regulatory bodies. In the company which Dr. Hess represents, each new process developed and each new expansion in manufacture is evaluated to reduce as much as feasible the pollution load to which it will contribute.

In discussing this paper, T. J. POWERS, Waste Disposal Division, The Dow Chemical Company, Midland, Michigan, commended the progress of the MCA in pollution control. He emphasized that standards set both for effluents and for receiving streams should be soundly established.

Effective treatment of cyanide wastes is now provided in five plants employing chlorine for oxidation; three operate under acid conditions, and two use alkaline chlorination. The handling of this waste was cited as an excellent example of solving a difficult waste problem. In many instances, it was held, the streams possess capacity for neutralizing considerable quanti-

ties of waste hydrochloric and sulfuric acids without pretreatment of the waste.

Atomic Energy Wastes

Perhaps the most important and interesting paper of the whole meeting was that on "PROBLEMS OF WASTE DISPOSAL FROM ATOMIC ENERGY OPERATIONS," by Arthur E. Gorman, Sanitary Engineer, Atomic Energy Commission, Washington, D. C.

The purpose of Mr. Gorman's paper was to discuss the problem of waste disposal in nuclear fission operations from the point of view of the sanitary engineer; to tell what is being done to resolve them; and to point out some of the opportunities and obligations which lie ahead.

[Because of the extreme importance of the topic, the editors will forego their usual method of reporting and reviewing papers and will present instead quoted excerpts from Mr. Gorman's paper.]

Mr. Gorman opened his paper with a brief description of nuclear fission operations and said, "In spite of its unique characteristics, the operations of this new industry follow a general pattern of other industries in many of its facilities and operating methods. As a consequence there is a definite parallelism in the problems it presents in waste disposal and environmental sanitation. Accordingly, in attacking and resolving these problems, well established principles can be applied subject, of course, to the fundamental differences in the properties of radioactive materials and the special procedures and precautions which must be followed in processing them.

"Nuclear fission operations start as do other industrial operations with raw materials which must be refined. The principal one is uranium ore, which must be crushed, sieved, and conditioned by a variety of other processes before it is ready for exposure to neutron bombardment in a 'pile' or reactor to produce new substances and energy resulting from nuclear fission. . . .

"The highly radioactive materials are produced after neutron bombardment of the prepared uranium in a 'pile' or reactor. . . . The heat resulting from nuclear fission is tremendous and must of necessity be controlled or considerable disintegration and possible destruction of the reactor structure itself would take place. In a reactor, this heat is dissipated by cooling, using air or water. These coolants, which are used in very large quantities, become radioactive. When they are disposed of they carry with them some radioactive waste products which are potentially hazardous and must therefore be subjected to treatment. . . .

"A property of all radioactive substances is progressive decay through emission of energy. . . . The half life of radioactive elements may vary from a few seconds to millions of years. Therefore, by a process of holding, the hazard of handling or exposure to certain short half life radioactive substances can be reduced. This is an important and significant factor.

"*Control Measures Necessary.* The usual safety and public health control measures carried out by well managed industries and research institutions are not adequate for complete protection of persons and property in the production and use of nuclear fission materials. This is because of the new hazards introduced by radioactivity. It is a reason why those of us who have been accustomed to considering industrial and environmental problems in terms of chemical, bacterial, biological and general physical properties must broaden the scope of our appraisal to include radioactivity. . . .

"It is this environmental phase of the problem which is of special interest to the sanitary engineer. . . . The need of educating and training sanitary engineers and other specialists in nuclear physics and its applications in the expanding field of atomic energy is recognized by the Commission. A small group of sanitary engineers and chemists in Federal agencies, other than the Commission, are being given training at Oak Ridge and Los Alamos; and it is planned to expand this activity to water and sewage plant operators and public health officials.

"*Problems of Water Supply* . . . . A water-cooled reactor requires a large volume of water for heat-exchange purpose, and this water must be disposed of. . . . Through knowledge of the amount of this energy in particles or radiations which the human system can tolerate with safety, it is possible to determine the extent of hazard involved in the disposal of such wastes.

"As all radioactive substances undergo decay until they cease to emit energy, knowledge of the length of time required for this decay provides one method of appraising the extent of the problem. Consequently, retention is one method of treatment relied upon for cooling water which must be returned to streams. Unfortunately, some radioactive substances have long half lives. In such cases, these substances must be removed from water used for cooling reactors unless their quantities are in such small amounts that with dilution the hazard of their existence is negligible. The technical control on treatment of water used for cooling nuclear reactors must be of the highest order. . . .

"The discharge of radioactive waste products into or onto the ground also has potentialities of contaminating water supplies. . . . Radioactive waste products with long half lives could create serious hazards. . . . Where such wastes are disposed of to the soil, it is of basic importance that information be obtained as to the rate of flow of the ground water and the dilution possibilities so that at all times the extent and degree of contamination may be known. . . .

"There is evidence that such processes of water purification as coagulation and sedimentation and sand filtration are quite effective in removing some radioactive substances from water. The problems of disposal of the radioactive sludge and controlling the build-up of radioactivity in filter media are deserving of special consideration. . . .

"Still another aspect of radioactivity in water, interesting and significant to sanitary engineers and biologists, is evidence that such energy does not unfavorably affect

More Programmers

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many plankton growths and is accumulated within these organisms. Algae and other forms are known to grow prolifically in water which is quite radioactive. The potentialities and significance of this finding are especially interesting and important to all interested in the biology of streams and their subsequent use as sources of industrial and public water supplies.

"Problem of Waste Disposal—Waste from nuclear fission plants as from most industries are liquid, dry, and gaseous. . . .

"Waste products with little value but having radioactive or toxic properties must be disposed of. This poses a problem both of economics and of safety. Cribbing and lagooning, which are common practice in many industries, have been carried out with a fair measure of success, but it is recognized that such practices have potential hazards and limitations. . . . One of the unique problems in the nuclear fission industry is that equipment and facilities which come in contact with highly radioactive contamination also become contaminated and, therefore, must be decontaminated or be disposed of. For this reason, use of many of the methods and much of the equipment common to other industries for treatment of industrial waste must be ruled out or modified because of the end problem of ultimate disposal. . . .

"There has been some concern on the part of operators of sewage treatment works that the disposal of waste resulting from the use of radioactive isotopes at hospitals and research institutions might have an adverse effect on the sensitive biological processes at these works. Their concern is wholly understandable and, currently, research programs are being initiated designed to obtain basic facts. The rapid increase in the use of radioactive isotopes in institutions and industry poses many other problems which call for answers such as the degree, if any, to which plumbing fixtures in buildings and facilities in sewer systems can become radioactive.

"Techniques and Tolerance Limits—In any consideration of contamination, scientists are accustomed to make use of certain standards or permissible levels. Sanitary engineers already need some guides as to relative degrees of radioactive contamination, techniques for their measurements, and safe limits for public safety and health. The radiologist and the health physicist have done much to develop such techniques, standards, and equipment. . . . By means of instruments, such as electroscopes, Geiger counters and ionization chambers, they evaluate the radioactive energy from nuclear particles, such as alpha and beta particles and gamma radiations.

"Examples of Attack.—A great deal of excellent work has been carried out and is in progress or planned for resolving the problem of protecting man and his environment against radioactivity. Of special interest to sanitary engineers are the following: Experiments to determine the most favorable atmospheric conditions under which to carry out operations; manual of Standard Safety Requirements containing information to be used by plant operators in protecting personnel . . . and studies and evaluation of surface and subsurface contamination of water supplies where radioactive and toxic wastes may be discharged into or onto the ground. Such problems are currently being given special consideration at the Hanford Works in Washington, Oak Ridge in Tennessee, and at the Brookhaven National Laboratory on Long Island. In addition cooperative programs with the Public Health Service and the Tennessee Valley Authority . . . and with New York University for study of the effect of radioactivity on biological processes especially those common in sewage treatment and stream pollution. . . .

"In conclusion, we should like to re-emphasize that (1) the continued expansion of the nuclear fission industry presents many problems and, therefore, an opportunity and a challenge for the trained sanitary engineer; (2) the Atomic Energy Commission is striving actively for a permanent solution of its waste disposal problems; (3) its objective is that this new industry may expand to meet its potentialities without creating objectionable or hazardous conditions at and in the vicinity of its plants as many new industries have done; (4) sanitary engineers should be trained in fundamentals of nuclear physics so that they may have a better understanding of this new industry and its environmental problems; and (5) the need of training sanitary engineers is especially acute considering their responsibilities in a national defense program."

W. E. Stanley
Prof. San. Engr.
M. I. T.
Cambridge, Mass.

G. P. Edwards
Ch. of Labs.
Dept. Pub. Wks.
New York City

R. D. Hoak
Sr. Fellow
Mellon Inst.
Pittsburgh, Pa.

F. S. Friel
Cons. Engr.
Albright & Friel
Philadelphia, Pa.

Programmers and Discussors

(The following papers are reported by A. Paul Troemper, Principal Sanitary Engineer, Ill. State Health Dept., Springfield, Ill.)

Activated Sludge

"FACTORS AFFECTING THE EFFICIENCY OF ACTIVATED SLUDGE SEWAGE TREATMENT PLANTS" was the title of the paper by William E. Stanley, Prof. of San. Engr., Massachusetts Institute of Technology, Cambridge, Mass.

Prof. Stanley presented a considerable amount of detailed operating data on 26 activated sludge plants located in 23 cities. The operation data covered periods of from one to seven years and a wide variation in operating conditions between the individual plants. The detailed operating data for the various plants were presented as a series of slides.

It was shown that short-time loadings as high as 80 lb. of B.O.D. per 1,000 cu. ft. of aerator capacity could be reached without appreciably reducing the efficiency of the units. Return sludge rates as high as 55 per cent were used. The sewage temperature had little apparent effect on the operation of the activated sludge process.

Prof. Stanley indicated that, based upon the data presented, reductions of 92 to 95 per cent in both B.O.D. and suspended solids might be expected from the activated sludge process operating on domestic sewage. Where industrial wastes are discharged to the system the reductions may be somewhat lower. More effective design and operation of pri-

Inspection Trip

Cleon Oakes
Supt.
Detroit, Mich.

E. A. Huster
and
C. H. Gembolis
Eimco-Chicago

George S. Russell
and Sons
Jess (left) &
George D.

C. C. Larsow
Springfield, Ill.
and Jack Cooper
Dearborn, Mich.

Bruce McDill
Ohio Dept. Health
Columbus, Ohio

mary units will benefit the efficiencies of the process.

Discussion of this paper was by GAIL P. EDWARDS, Chief of Laboratories, Department of Public Works, New York, N. Y. Dr. Edwards pointed out that some relation must exist between plant loading and plant performance; however we are not sure of the factor. He introduced the term "sludge age" as an operating parameter for activated sludge plants. Sludge age was defined as the reciprocal of the ratio of the pounds of sewage solids added to the system daily, to the pounds of activated sludge solids in the system. A sludge age of three to four days was recommended as being desirable. Dr. Edwards maintained that the sludge age was a better operating parameter in an individual plant than some of the other parameters which have been used, and which were considered better for comparing operations of different plants.

Dr. Edwards pointed out that a better sludge index could be expected with step aeration than without it, when aerator loadings were the same in both cases. At a loading of 100 lb. of B.O.D. per day per 1,000 cu. ft. of aerator capacity, suspended solids removals of 83 per cent were obtained and B.O.D. removals of 77.5 per cent. The sludge age in this case was 0.37 days. Air supplied was 353 cu. ft. per lb. of B.O.D. removed.

Sewer Maintenance

Lloyd D. Knapp, Supt., Bureau of Sewers, Dept. of Pub. Wks., Milwaukee, Wis., presented a paper on "SEWER SYSTEM OPERATION AND MAINTENANCE PROCEDURES AT MILWAUKEE."

Mr. Knapp presented a detailed description of the organization and operations of the sewer maintenance activities in Milwaukee. He prefaced his remarks by advising that the sewers in Milwaukee were designed to allow a 2-foot per second velocity. The entire sewer system has been divided into divisions for maintenance purposes. The presentation then consisted of a description of the crews used for various purposes and the equipment used by the crews. The use of hydrocranes was practiced by the construction crews wherever possible and has resulted in a reduction in cost of 30 per cent below that for hand digging. The construction crews were used on repair jobs during the winter months. Accident prevention committees have been organized by supervisory employees. These committees have been effective in holding the accident experience low.

Cleaning crews use primarily sewer turbines and Champion machines. The flushing crews, of which there are four, are furnished with hose, flushing bag, etc. Rubber coated hose is used in the winter. One length of rubber coated hose is used in the manholes in the summer. All catch basins are cleaned once each year by the two catch basin crews. Eductors are used wherever possible. With eductors each crew can clean twenty catch basins per day. A sewer trouble man is located in each district. He investigates all complaints in his district and advises the property owners of the corrective action which can be taken in each case. He may also help out on other jobs in slack periods. Sewer examining crews are also provided to examine the structural condition, amount of flow, depth of deposit, etc., of the sewers periodically. They are also used to examine contract work upon completion. They may also be used by the construction engineering forces. Sewer masons are also employed to set new manholes, repair old ones, etc. Approximately 25,000 manholes must be maintained. Yards are maintained for all special tools and equipment. A total of $529,000 will be spent for sewer maintenance and repair in 1948. This is an average of $480 per mile.

FRANCIS S. FRIEL, Cons. Engr., Philadelphia, Penna., discussed Mr. Knapp's paper.

Mr. Friel outlined the organizational setup in Milwaukee which consists of the following subdivisions: Design, Construction, Engineering, Accounting, Maintenance. The safety plan is a good one and has been responsible for a good safety record. Maintenance of all residence sewers from the main to the building is the responsibility of the property owner. It has been the practice in Milwaukee to use vitrified clay pipe to sizes up to 36 inch and concrete pipe from 36 inch to 66 inch. Vitrified liners are used where needed. Concrete pipe is generally used in the residential districts where normal domestic sewages are received and vitrified clay pipe is used in the manufacturing areas.

Another point discussed by Mr. Friel was the use of magnetic needles for locating buried manholes. The practice of having sewer examining crews was considered a good one. He pointed out that no difficulty had been experienced with hydrogen sulfide fumes or septic conditions in the sewers due to the 2-foot per second design velocity. He also brought out the point that sewer rental charges for industrial wastes should take into consideration the effect of the wastes on the sewers as well as the problem presented by their treatment.

Detroit's Sewage Works

Messrs. Fred Burley and W. M. Wallace, respectively, Supt. Sewage Treatment Plant, and Supt. of Filtration and Sewage Treatment, Detroit, Mich., presented a paper on the "DESIGN AND OPERATION OF THE DETROIT SEWAGE TREATMENT PLANT." This paper immediately preceded the inspection trip to the plant. This inspection trip was described in the previous installment.

OPERATOR'S FORUM

(Leader: Ralph E. Fuhrman, Wash, D.C.)

The closing session of the meeting was conducted as an Operator's Forum, wherein six topics were discussed informally by a number of plant superintendents, chemists and others under the leadership of Ralph E. Fuhrman, Supt. of Sewage Treatment, Washington, D.C., as conductor of the forum.

Inspection Trip

H. V. Crawford, Appl. Engr., Gen. Elect., Schenectady, N.Y.

F. S. Friel and Friend

R. R. Kennedy, San Francisco, Calif.

Stu Coburn, Boston, Mass. and Dr. Rudolfs

W. D. Hatfield, Supt., Sanit. Dist., Decatur, Ill.

Annual Reports of Plant Operation

C. C. LARSON, Supt. of Water and Sewage Treatment, Springfield, Ill., introduced the topic by calling attention to the few Annual Operation Reports which have recently been submitted to the Federation in the annual prize competition for the best reports. He pointed to the fact that the greatest value of the Annual Operating Report is actually to the man who prepares the report. In the make up of such reports he stressed the importance of a good index, the use of easily understood graphs, and tabulated data, and a minimum of technical discussion. These reports should be designed for others than the technical man if they are to serve the greatest purpose and reveal to the general public what is being accomplished.

WALTER A. SPERRY, Plant Supt., Aurora, Ill., pointed out the value of preparing monthly operating sheets which are posted on the plant blackboard and thereafter used in preparation of the annual report with far greater ease. The annual report should actually serve as a plant operation record for comparing present and past performance as well as costs.

K. L. MICK, Plant Supt., Minneapolis-St. Paul, Minn., a prize winner in the annual report competition, stated that the $200 spent per year on Annual Operating Reports had proved the best possible investment in better public relations. The cost is $1.00 per copy for 200 copies.

L. W. VAN KLEECK (Hartford, Conn.) and F. W. JONES (Cleveland, O.) also stressed the public relations value of well prepared annual reports, which should be understandable to editors of local newspapers.

Corrosion of Sludge Digesters

L. C. HUFFMAN, Plant Supt., Dayton, Ohio, reporting on floating covered digesters after 6 years of operation found the steel covers coated with slime but no corrosion in evidence. The wrought iron heating coils were found coated with dried out sludge 1 inch thick. The coils were removed, cleaned and replaced. Corrosion had been negligible.

G. E. FLOWER, Plant Supt., Cleveland, O., during 10 years of floating cover operation had observed no corrosion on the interior surface during two inspections. Corrosion on the outside of the skirts of the covers had been slight.

A. H. NILES, Plant Supt., Toledo, O., with 16 years' operating experience with floating cover digesters had found no corrosion of heating coils, or hangers, or channels. Some small horizontal bracing members (steel rods) of the rotating sludge concentrating unit had pitted badly, probably because of stresses or different composition of steel.

C. C. LARSON, Plant Supt., Springfield, Ill., had observed no corrosion of floating covers after 19 years of operation. Under the film of grease and soap the original paint was found as good as new.

L. S. KRAUS, Plant Supt., Peoria, Ill., commenting on a gas holder had found no corrosion of the vertical walls but the bottom had practically gone. Galvanic action had been shown to be the cause.

JOHN STRELOW, Plant Supt., Davenport, Ia., reported corrosion of pipe coils between the wall hangers.

C. C. AGAR, N.Y. State Dept. Health, said that corrosion of digester parts could generally be traced to galvanic action. There being no standard pattern for corrosion, the taking of current flow measurements will generally reveal where corrosion is in progress. In northern N.Y. plants with high heat input requiring wrought iron heating coils had been replaced twice in 10 years. The considerable difference in temperature at various points along the heating coil will set up galvanic effects which can be dissipated by shunting the coil to secure equalized current density at all points on the coil.

One member pointed out that the only corrosion noted on the inside of floating covers had been along the weld seams where the protective coating had not been sufficient to prevent galvanic effects.

Maintenance of Electrical and Mechanical Equipment

GEO. E. FLOWER, Plant Supt., Cleveland, Ohio, stressed the importance of a good shop, well equipped, if efficient maintenance is to be realized. As to spare parts, the manufacturers should be consulted regarding the more essential spare parts to stock. Gas engines require yearly overhauling and new rings every three years. The importance of the best lubricants obtainable at whatever price was stressed. Many dollars can be spent on lubricants before the cost of a bearing replacement will be equalled. And to insure the most effective and dependable lubrication one individual should be assigned the job of lubrication supervision and develop a rigid lubrication program. In adding grease to ball bearings the only safe practice is to run the unit with the bearing plug *out* a sufficient time to unload any excess grease before replacing the plug. Too much grease in a ball bearing is probably worse than too little because of damage from over-heating when the bearing is too full of grease.

Records of stoppages, breakages, etc. should be carefully studied daily by the plant superintendent for improving protective maintenance.

In connection with incinerators of the multiple-hearth type, rabble arms on the lower hearth had been bending down until replaced with arms containing 35% chrome and 5% nickel.

Gas engine mufflers had given trouble from corroding or burning out. The use of a 10 in. pipe cut on the diagonal 120 in. long for the 10 in. diameter had been effectively substituted for the original muffler.

M. A. GROEN, Plant Supt., Dearborn, Mich., advocated securing ad-

vice from lubrication specialists and standardizing on the minimum number of grades of lubricants as a practical matter. Lubrication can either become very complex or very simple and the best advice will pay well in the long run. The matter of standardizing also on motors is of importance when considering the variety and number of spare and replacement parts which should be kept in stock.

H. V. CRAWFORD, Genl. Electric Co., stressed the lack of warning of electric equipment failures. Amongst the more important parts to stock he recommended one spare set of stator coils for every three motors. To subdue moisture condensation and corrosion he advocated heaters for all electric cabinets in sewage plants.

L. C. HUFFMAN, Plant Supt., Dayton, Ohio, questioned the economy of maintaining a complete machine shop at any but the very largest plants. In Dayton where repairs and maintenance work depend on outside shops the expense is about $2,000 per year—considerably less than the overall cost of an adequately equipped and manned shop at the plant.

Public Relations

J. W. JOHNSON, Plant Supt., Buffalo, N.Y., led off in the discussion of Public Relations which he said "always began at home." It is important to encourage the public to visit and learn about the plant and what it does. The Detroit plant served as a good example of how descriptive and informative signs, and arrows to guide visitors through the plant, could be employed.

R. A. GREEN, Plant Supt., Jackson, Mich., also stressed the value of satisfied employees and described the 55 acre development surrrounding the Jackson plant. The development of a series of lagoons stocked with white ducks and swans and bordered with willows and attractive shrubbery had attracted many visitors. The adjacent picnic grounds was used by 75 to 100 people per day during summer. Every visitor received an illustrated pamphlet describing the plant, its functions and operation.

C. C. LARSON, Springfield, Ill., pointed out the good or bad relations which could come from the manner in which complaints are received and handled. Prompt, polite service was usually long remembered by the person in trouble and needing help.

PAUL MOLITOR, Plant Supt., Rutherford, N.J., stressed plant cleanliness and absence of odors as of paramount importance when encouraging visitors.

LESLIE A. WEST, Plant Supt., Elizabeth, N. J., advocated affiliation of plant managers with local service organizations, also the giving of talks at every opportunity.

Others contributing discussion were Morris Cohn on developing youth interest through the schools; F. W. Jones on the change in attitude of plant operators toward the state sanitary engineers who were now highly helpful, as against the police attitude of this group in years gone by.

Paints and Coatings

K. L. MICK, Chairman of the Federation Committee on Protective Coatings, explained the objective of the Committee as that of producing lists of recommended coatings for various services in sewage treatment. In this effort 250 questionnaires had been sent out to Federation members and replies from 42% had been received. He asked for cooperation and free exchange of information and experience with various coatings.

W. D. HATFIELD, Plant Supt., Decatur, Ill., said that surface preparation and the prime coat is the all important consideration in supplying any protective coating. He presented experience with phosphoric acid treatment of the surface as the best preparation yet tried. He had also had good results from the use of a rust remover sold under the name "Consol-M.", a product of the Inter Coastal Paint Co., East St. Louis, Mo. It is applied with a brush and after a period of contact the surface is wire brushed to remove the loosened rust. Inertol No. 33 had also been used with considerable satisfaction.

ED. DRUMMOND, Weideman & Singleton, Atlanta, Ga., stated that for underwater protection the bituminous coatings had proved superior.

F. H. BURLEY, Plant Supt., Detroit, Mich., reported satisfaction from the use of a wax-grease base compound (Compound "L.") of the Texas Oil Co. for wet locations. It is now being tried at various points. This material appears to be similar to Dearborn's "No-oxid".

For the interior of hot water systems at Detroit cement linings are being used. "Metallizing" is also being tried at various points. A material of unknown composition, known as "Surviron," is also under test in a severe condition—namely the open system chlorine evaporators.

W. D. HATFIELD (Decatur, Ill.) had tried the grease wax base coatings but stated that in hot systems (85° F. and above) these coatings will not remain in place.

Control of Sewer Usage

MORRIS M. COHN, City San. Engr., Schenectady, N.Y., and Editor *Sewage Wks. Engineering,* referred to the rapid increase of garbage grinding and disposal via. the city sewers. He reported that fancy had now become fact, as evidenced by the 200,000 household garbage grinders now in use. There are now on the market 18 different makes. He stated that garbage should be ground to produce ½ in. to ¼ in. size pieces and not more than 50% passing a 40 mesh screen.

SOL SEID, Plant Supt., New Brunswick, N.J., briefly described the Sewer Rental Ordinance of New Brunswick which places a large bit of the cost of handling industrial wastes on the industry which pays on the basis of volume but is charged for the chlorine required (chlorine demand) in addition. In the matter of collecting sewer charges Mr. Seid said that, based on experience, he would advocate the billing and collecting for sewer service on the same bill as the water service charge.

F. W. JONES, Havens & Emerson Engrs., Cleveland, pointing out that the Sewer Service Charge is here to stay, said it was his feeling that setting up limiting standards as to what is or is not acceptable in sewers, in the nature of industrial wastes, needed rather careful consideration as long as it is possible to handle the waste addition at the sewage treatment plant. As long as industry is agreeable to paying the extra cost for the treatment of its wastes, restrictions should be held to a minimum.

A. B. BACHERMS, Sewage Engr., Cincinnati, O., reported good experiences to date with the new Cincinnati Sewer Rental Ordinance which went into effect in July 1948. The service charge is included with the water service charge, there being no surcharge base for waste treatment in the present rate structure. There had been some protest from industry on the grounds that the water used fails to reach the sewer except in small part.

VAN PORTER ENLOE, Plant Supt., Atlanta, Ga., said that the bane of sewage plant operators was the three "Ks"—Klinkers, Kotex, Kundrums. He felt that in any Sewer Ordinance there should be careful coordination between the agency charged with issuing service connection permits and that which will regulate sewer use.

Comments of the Editors

"What it Takes—"

The writer has on frequent occasions been asked why such-and-such a meeting of a water or sewage works group has not "clicked"—or, "what are the most important considerations in developing good meetings?"

An attempt will be made to answer this last question, which in turn will serve as an indication as to why some meetings fail to attract a good attendance—at least a good attendance of the technical sessions.

According to observations in connection with attending a few hundred meetings during the past quarter of a century, it seems indisputable that the quality of the technical program constitutes the major factor by far for drawing attendance and holding the interest of those in attendance. It is not difficult for anyone with experience of as many years as that of the writer in attending meetings all over this country, and also in developing programs for the American Water Works Association for a number of years, to look over the technical program for any particular meeting and therefrom to predict in advance how well the meeting will be attended and to what degree the technical sessions will attract and hold those who do come to the meeting.

For the meeting to be successful, first of all the technical program must be diversified, must contain timely topics, and should also provide at least one Panel Discussion for each day of the meeting. It is the latter which seems to prove an attraction to the greatest number as is evidenced by the session attendance during the Panel Discussion periods. If some well known names can be listed as "Panel Participants" so much the better, and if these so-called "experts" can be stumped by floor questions, or those from unidentified questioners who place their questions in the prominently displayed Question Box in advance, so much the better—for zest is added thereby. In any case it has been observed that the Panel members feel somewhat flattered by their selection to serve as "experts." And, through the questioning and the exchange of opinions between the "experts" themselves, as well as the replies received by the audience, all are the gainers thereby. The beauty of the water and sewage works industry is that it is non-competitive and trade secrets are not an impediment to a free exchange of information and ideas. Therefore, information and helpful suggestions can be and are freely exchanged in the open meetings for the great benefit of all who come to learn as much as possible, as well as to participate in the lighter side of our meetings. We know of no other industry in which the younger men and those new in the field have the same opportunity to gain knowledge so rapidly and easily from those of long experience in the field.

Now, after a timely and diversified program has been developed, something more of marked importance is to be done—namely, to let the potential attendant know well in advance of the meeting dates what the program contains. In other words it is a truism today as always that *"You must show 'em to sell 'em."* And, this calls for the development of the program sufficiently in advance so that at least a preliminary draft of the program, in which the highlights are stressed, can be mailed out to members *and other potential attendants* well ahead of the meeting dates. Then also at least one follow-up reminder of the meeting with some reference to entertainment features as well as the technical program (even if only a postal card) will do much to influence the "undecideds" to plan attendance. A well repaid effort in this direction can be recalled as that of the Southeast Section of A.W.W.A. preliminary to its most recent meeting in Greenville, S.C. The attendance and interest in this meeting exceeded any for the section for some years, and has not been equalled since. The excellent program distributed to a wide mailing list in the southeastern territory well in advance and the impressive follow-up mailings did the trick. It spelled a much needed revival of the section. In connection with a meeting of the Md.-Delaware Water and Sewage Works Assn. a series of postal card reminders from the Publicity Committee in unique verse form proved highly effective. Here is a sample of verse taken from the final penny mailing card which bore the caption "Last Call!"—

Time's getting short
So check up and see
If on May 19 and 20
In Baltimore you'll be.

For the "Stump the Experts" session
Be sure to be on "Tap"
Win a silver dollar
It'll be a feather in your cap.

Those are some of the highlights
To make the meeting a success,
And it needs only *your* presence
To add the last bit of finesse.

Publicity Committee

Other associations and A.W.W.A. Sections have also effectively employed such follow-up reminders of meetings and program highlights—notably, the New Jersey Section with its novel facsimile of an informal hand written letter addressed to "Dear Friend" and telling of the highlights of the coming meeting.

Evidence of the worth of quality programs in attracting meeting attendance has just recently come to my notice—notably the first meeting of the new Alabama-Mississippi Section of A.W.W.A. in Montgomery, Ala.; the Ky.-Tenn. Section in Chattanooga, Tenn.; the Minnesota Section in Winnipeg, Canada; the California Section in Riverside, Calif., with an all-time attendance record established.

On the other side we will refrain from naming a few recent meetings which have been disappointing, either because of mediocrity of program or worse, because a good program simply was *not* ready for mailing out sufficiently in advance of the meeting. An outstanding example of year in and year out successful meetings are those of the Canadian Section of A.W.W.A. which is reputed for its well diversified programs and its featured "Guided Discussions" in which plant operators and managers participate freely and perhaps at times heatedly. The reminder mailings from Secretary Berry's office calling attention to the highlights of the programs, are exceptional in character and evidently also in their effectiveness.

These appear to this writer to represent the major answers to the question—"What does it take to insure a successful meeting?"

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Precision Engineered for Long, Hard Service

15 Years of Service . . . Over 1700 Installations

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From the Mediterranean to the Philippines; from the Arctic Circle to Australia, wherever there is modern sewage treatment, you will find Comminutors. Such world-wide acceptance is based on a machine that efficiently and effectively performs a service unmatched by any other type of equipment.

The Comminutor, compact, economical, silent, does away with the need for screens, rakes, grinders, burial pits and incinerators or other means of destroying the filth that is obtained by the old methods. With no screenings to stand in the open, there is no odor, no additional labor, and none of the unsightliness usually connected with screenings and their disposal.

The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

If you have work in the sewage treatment field, write today for the Comminutor Bulletin which gives complete engineering data.

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SCRU-PELLERS • SAMPLERS • NON-CLOG PUMPS

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HYDRAUGER machines are available in 3 different types (3.2 and 5.2 horsepower). Bores 2 in. and 2½ in. hole. Bore-reams 3½ in., 4½ in., 6½ in., 8½ 10½ in., 12½ in., 14½ in. and under certain conditions to 24 in. dia. hole.

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MEETINGS SCHEDULED

JAN. 19-21, 1949—NEW YORK, N.Y. (Commodore Hotel)
American Society of Civil Engineers. Sec'y, Wm. N. Carey, 33 West 39th St., New York, New York. (Sanitary Engineering Division, Thursday, Jan. 20, a.m. and p.m.)

JAN. 21-22—NEW YORK, N.Y. (Pennsylvania Hotel)
New York State Sewage Works Association. Sec'y, A. F. Dappert, State Dept. of Health, Albany, N.Y.

JAN. 21—NEW YORK, N.Y. (Pennsylvania Hotel)
New York Section A.W.W.A. (Mid-Winter Luncheon 12:15 p.m.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N.Y.

Joint Luncheon, Friday, Jan. 21, Hotel Pennsylvania, Main Ballroom 12:15 p.m.—N.Y. State Sewage Works Ass'n, A.S.C.E. Sanitary Engineering Division, and N.Y. Section A.W.W.A.

FEB. 17—NEWARK, N.J. (Essex House)
New Jersey Section A.W.W.A. (Luncheon Meeting) Sec'y, C. B. Tygert, P.O. Box 178, Newark, N.J.

MARCH 23-25—TRENTON, N.J. (Hotel Stacy-Trent)
New Jersey Sewage Works Association. Sec'y-Tres., M. S. Kachorsky, P. O. Box 283, Manville, N.J.

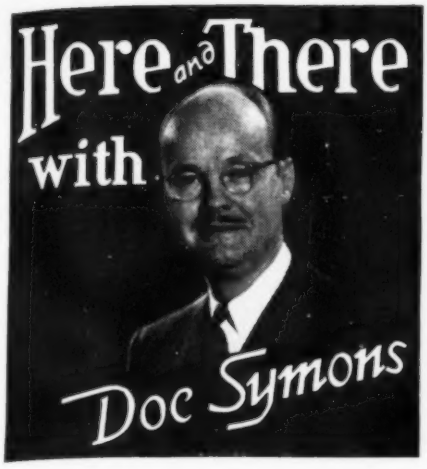
MAR. 31-APRIL 1—NATURAL BRIDGE, VA. (Natural Bridge Hotel)
Virginia Industrial Wastes & Virginia Sewage Works Association. Sec'y, A. H. Paessler, 815 E. Franklin St., Richmond 19, Va.

APRIL 11-13—LITTLE ROCK, ARKANSAS
Arkansas Water & Sewage Conference. Sec'y, Dr. Harrison Hale, Univ. of Arkansas, Fayetteville, Ark.

APRIL 28-29—ELMIRA, N. Y. (Mark Twain Hotel)
New York Section A.W.W.A. Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N. Y.

MAY 30-JUNE 3, 1949—CHICAGO, ILL. (Stevens Hotel)
American Water Works Association Annual Conference. Exec.-Sec'y, Harry E. Jordan, 500 Fifth Avenue, New York 18, N.Y. (All reservations will be cleared through the A.W.W.A. office. Reservation forms will be mailed to members after November 1.)

JUNE 23—WANAQUE, N.J.
New Jersey Section A.W.W.A. (Outing and Inspection) Sec'y, C. B. Tygert, P.O. Box 178, Newark 1, N.J.



H.T.M.A.—And here we are, starting a new year—together. Just to vary the routine, this year I'm not going to do any predicting. Last January, you may remember, I predicted that **W.&S.W.** would come up with a couple of new ideas (how about the Reader Service Cards and the *Water & Sewage Works* Notebooks) and in February, I wrote ". . . Wonder what this year of '48 holds for all of us? For myself, I've a feeling it holds a lot in store." And it did!!!—

There were some wonderful conventions—Niagara Falls, Ont., Atlantic City, Cincinnati, Milwaukee, State College, Penna., Clarksburg, W. Va., Detroit, Richmond, Va., Ottawa, Ont., Galveston, Tex., Riverside, Calif., and a dozen or more others—and there were wonderful people everywhere. I discovered further proof that water and sewage works men all over the country have beautiful wives, among them an artist, a poetess, a dancer, and several amateur columnists of great talent.

I heard some wonderful stories, most of which I have passed on to you, and I had the opportunity to tell a few stories of my own to some very wonderful audiences. The year wasn't all Scotch and Soda (or, if you prefer, ice cream and cake)—Oh well—. One thing that did happen to me left its mark—and in 1949

there'll be a new "Doc" Symons, "here & there," as you can well see here.

Alhydro FLOC PRODUCER

FOR INDUSTRIAL OR MUNICIPAL WATER TREATMENT PLANTS AND SWIMMING POOL INSTALLATIONS

"It's the answer to turbidity and color removal"

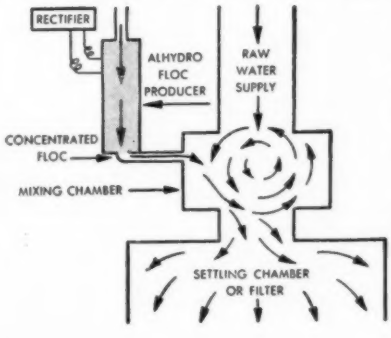
"Right! The most efficient formation of stable floc yet"

The Alhydro Floc Producer assures continuous production of a readily controllable concentration of aluminum hydroxide floc. And Alhydro floc is completely stable . . . will re-form immediately if broken up by pipes or pumps.

The Alhydro unit uses only aluminum plates and low voltage direct current to form the floc. Thus, it makes 69 lbs. of aluminum treat as much water as nearly ¾ ton of ordinary coagulants . . . solves the problem of chemical storage.

Simple to operate, easy to maintain, one unit measures only 45″ x 13″ x 34″, and will treat an average of 300,000 gallons of water per day. The Alhydro unit may be installed singly or in multiples, in existing or proposed water treatment plants.

This installation of ALHYDRO FLOC PRODUCER in your water treatment plant will provide you with . . .



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And now to the business of another year's columns.

* * *

Add members of the **N.O.B.D.**—Allan A. Tukey, one of the Commissioners of the Metropolitan Utilities District of Omaha, Neb., and boss of Walter S. Byrne, Gen. Mgr. of the Omaha Met. Util. Dist. and himself a member of the N.O.B.D.; Gilbert R. Frith, Asst. San. Engr., Georgia Dept. of Health, Atlanta, Ga.; Cleon A. Oakes, Supervisor, Sew. Trt. Plt., Detroit, Mich.; R. S. (Dick) Beckett, Chief San. Engr., Del. State Health Dept., Dover, Del.; and Tom E. Driskell, Sales Engr., Ohio Salt Co., Wadsworth, Ohio—The list is growing.

Any one else?—And for those of my new readers who don't know what N.O.B.D. means, it is a club I organized called the **N**imble **O**rder of **B**um **D**igits and only persons who have lost some part of a finger or hand are eligible to join. If you are eligible just send me an outline of the hand that has been nobbed, and I'll list you as another walking warning to others to follow safe practices.

* * *

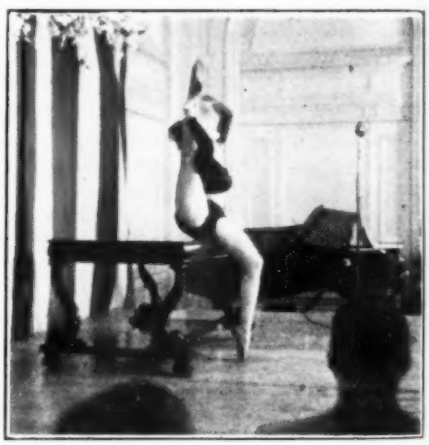
Do you remember when I offered last March to send to those who requested it a copy of a small card which read "Why Be Difficult—With A Little More Effort, You Can Be Impossible." They were being handed out by E. A. (Sig) Sigworth of Nuchar fame. I had nearly 30 requests which I turned over to Sigworth. I also had a letter from James T. Polter, Calgon Representative in Charlotte, N.C. Polter wrote in part as follows: "I accelerate my response to the card Siggie Sigworth mentioned in the March issue . . . If that damyankee Siggie ever crosses the Smith & Wesson line again, he can expect me to blast him from here to . . . Siggie swiped that card from me and since I have the southern monopoly on plagiarism from whence Siggie got the idea, I protest. Before Siggie swipes any more of my swiped cards, I am sending you a complete set just to prove Calgon is in the fore."

If any of my readers desire the 12 cards of varying inscriptions, just fill in a Reader Service Card with the key number HT-1 and I'll see that Mr. Polter gets your orders.

* * *

A fellow said to me, one time: "Doc, what kind of pictures do you get when you snap them during banquet entertainments, etc."

Here's the answer—taken at the N.J.S.W.A. meeting in Trenton, last March. You figure it out.



* * *

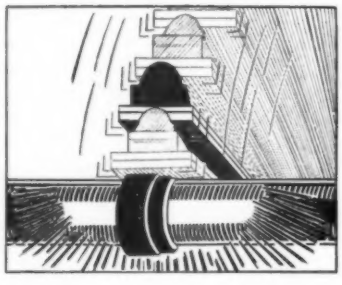
A year ago last August, when I came home from the Penna. Water Works Operators Association meeting in State College, Penna., I brought with me a severe strep throat and I do mean Strep. While on a diet of penicillin and sulpha-diazine under the doctor's watchful eye, he asked me if I could have picked up the bugs from the water out there.—This is to report to R. Y. Sigworth, Supt. of Utilities at Penn State, that I set the good doctor straight.

P.S.—This year I fared better.

How Much PUNISHMENT Should Bell and Spigot Jointing be able to stand?

TO FIND THE RIGHT ANSWER TO THAT ONE, WE MADE THIS EXPERIMENT!

TWO 12′ lengths of 4″ bell & spigot pipe were joined up with *Tegul*-MINERALEAD to form a span of 19′ between supports. The joint was centered under a "hammer" formed of 50 lbs. of iron bolted to wooden beam and actuated by motor and cam • This "hammer" pounded the joint for *fifteen hours*, delivering 100 smashing impacts per minute, 6,000 per hour — about 90,000 total • These impacts were increased by the spring and recoil of the beam • Throughout the test 90 lbs. water pressure was maintained in the line • When the motor was shut off at the finish, there wasn't even a sign of leakage • In this extraordinary experiment considerably more punishment was delivered in fifteen *hours* than your bell & spigot line would meet in fifteen *years* of normal service.



Tegul-MINERALEAD is the *original* ingot form jointing compound—impervious to moisture and to shake-down in transit. Its Thiokol content cuts initial leakage, so back filling can be started at once, clearing up open trench hazards • *Tegul*-MINERALEAD works easily in any temperature, needs no caulking, deep bell holes or skilled labor • From every angle *Tegul*-MINERALEAD is fast, clean, efficient and economical • Write for full information.

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Add New Uses for Chlorine—At the N.J. Section A.W.W.A. meeting in Atlantic City in November last year, there was a "Symposium on Uses of Chlorine." E. A. Sigworth of the Nuchar Sigworth's came up with this one.—

Sig didn't remember the city, but some place in Jersey a water works Supt. was annoyed by a group of young boys shooting craps just outside the waterplant grounds. Repeated calls to the police brought repeated "raids" but the boys always scattered.

So Mr. Supt. ran a hose from his chlorine room through the shrubs to a point near the open air "crap table." When next the game got under way, a shot of chlorine was dispatched to the "gaming room" via the hose. First time the boys sniffed, coughed a couple of times and went on with the game. The next dose was larger and longer. The game broke up precipitously and to all accounts hasn't been resumed since.—Wish I knew where that enterprising supt. lives.

* * *

In the Sept. column, I mentioned that I was down at the Cincinnati Symposium on Research, held under the auspices of the U.S.P.H.S.—One of the prize presentations was the colored movie on algae presented by Prof. Silvey of Texas A & M.—Also a prize was his opening remark that for a speaker to be given the topic of "Algae" to talk about was about like being told to "Describe the universe and give two examples."

There were other happenings there that I propose to report to you later, but at this moment I only want to tell you that C. J. Regan, Chemist in Chief, and W. P. Warlow, Div. Engr. (Main Drainage) of the London County Council were in attendance. They also attended the Milwaukee meeting of the C.S.S.W.A.

* * *

MATTER OF HISTORY (AND SUCH)—One Wendell R. LaDue submitted this bit for the edification of the S.O.C.B.—**Council Bluffs,** 1803, a spot on the east bank of the Missouri River; 1804, Lewis and Clark conferred (counciled, that is) with the Indians on their way to "take" Oregon; 18??, Fort Calhoun; 1846, Kanesville, a Mormon settlement, later abandoned in favor of Salt Lake City; 1850, Chartered as COUNCIL BLUFFS (hooray!) County seat of Pottawattamie County, Iowa; water works municipally owned and operated; population, 1900 — 25,802; 1910—29,292; 1920—32,458; July *18,* 1947—41,450; July *19,* 1947—

NOW READY . . . for immediate use or for your blower data files

Essential data at your finger tips—if you use blowers, you need the data in this new booklet.

Shows details of operating principles, design and construction, along with typical installation views illustrating a wide variety of industrial applications.

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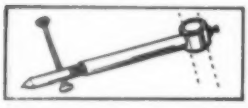
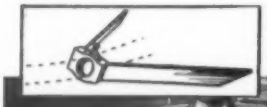
NEW—"FLEXIBLE" LOWER MANHOLE JACKS

SAVE TIME AND WORK AND EQUIPMENT

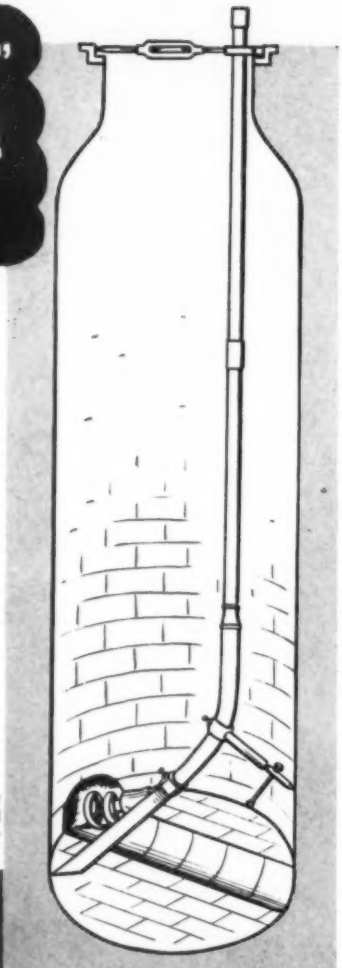
"FLEXIBLE" experience again provides new methods of simplifying tough jobs. These two new Lower Manhole Jacks brings sewer and line cleaning operations another step further into the open. They also speed tool changing. Note how the coupled rod guide is quickly, firmly, simply anchored at the bottom of the manhole. Also note that the face of the bell is held away from the lip of the sewer line itself. This enables operators to see roots before they jam tight in the rod guide.



Adjustable Back Jack (Optional use). Perfect for getting additional anchorage of rod guide. Sold separately.



Adjustable Foot Jack. Ideal for use with proven "Flexible" Steel Rod system of cleaning sewer lines. Sold separately.



Lower Manhole Jacks in position. Clear working face at sewer is provided as well as comfortably small amount of rod bend into sewer line.

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41,438; famous AGAIN for American Water Works Association trek west in July, 1947. Famous persons passing through—Van Atta, Saunders, La-Due, Boehner, Symons, Jones, Newkirk, Griffin, et us. et al.

* * *

Well, here it is, I've run out of space again—and there are still several bits of unfinished business from 1948. So-o-o, I'll give next month's column over to it instead of doing a review. O.K.??

V.T.Y.——Doc.

[Overflow from the main section]

"Snobby"

This interesting sketch of a very much dressed up fire-hydrant appeared under the caption "St. Louis Oddities" in a Sunday edition of the *St. Louis Post-Dispatch.*

The Hi-hat Hydrant

This hydrant is on the St. Louis County Water Co.'s system, which however disclaims any responsibility for the decoration. The name "Snobby" derives from the first letters in the names of four families whose property this hydrant guards—the Schewes; the Newtons; the Oonks; the Bradleys. H. J. Bradley is responsible for the unusual appearance of what he has dubbed—"Snobby—the Animated Fire Plug."

(For the sketch we are indebted to W. Victor Weir, President, St. Louis County Water Co.)

New Ala.-Miss. Section Holds First Annual Convention

Grade "A" Technical Program Attracts Large Attendance

The first annual meeting of the new Alabama-Mississippi Section of A.W.W.A. was held in Montgomery, Ala., October 13, 14, and 15. The total men's registration was 116, with 140 persons attending the banquet on the second night of the meeting.

The meeting was called to order by Chairman Arthur N. Beck, Chief Engr., Ala. Dept. of Health, who presided during the first day. Mayor John L. Goodwyn of the City of Montgomery welcomed all in attendance.

Technical Sessions

The technical sessions opened with an interesting talk by Dr. A. P. Black, Vice-President, A. W.W.A., on "Recent Advances in Water Treatment." Discussion from the floor was led by William E. Johnson, Con. Engr. of Jackson, Miss., and Paul Krebs of Polglaze & Basenberg, Engrs., Birmingham.

Following the above discussion, an enlightening paper on "Consumption, Conservation, Waste and Leaks" was presented by H. E. Beckwith, Dist. Manager, Pitometer Co., Pittsburgh, Pa. Discussion of Mr. Beckwith's paper was led by Prof. T. M. Lowe, Alabama Polytechnic Inst., Auburn, Ala., and Frank Crow, Mgr. of Water Works, Florence, Ala. During this discussion, the old favorite of water works men came up, the subject of jointing materials and methods of making proper pipe joints. Needless to say, this discussion lasted until the meeting had to be adjourned.

The Manufacturers' Association and manufacturers' representatives attending the meeting were hosts that night at a Cocktail Party and Buffet Supper in the Civic Room of the Whitley Hotel.

The second morning of the meeting opened with Baxter H. Wade, Vice-Chairman, presiding. M. E. Henley, Wallace & Tiernan Co., described "Distribution System Disinfection" which was followed by a discussion by those present sparked by Glenn W. Cowham, Supt. of Water, Montgomery, Ala., and R. M. Striger, Sales Eng., Feemster & Striger, Jackson, Miss.

Frank Hall, City Engr., Greenville, Miss., gave a paper on "Municipal Well Water Supplies," and discussion of this paper was led by T. H. Collins, Mgr., Water Works Board, Ozark, Ala.

The afternoon session featured a paper on "Internal Corrosion and Its Prevention," by Sherman Russell, Supt. of Purification, and A. T. Story, Chemist, both of the Atlanta Water Works, Atlanta, Ga. Discussion of this paper was led by Dr. John E. Gran of the Univ. of Alabama, and E. M. Stickney, Water Works Manager, Mobile, Ala.

J. C. Clarke, Director, Alabama Water Improvement Advisory Commission, next presented a detailed description of "Alabama's Stream Sanitation Program," and Prof. Gilbert H. Dunstan of the Univ. of Alabama led the discussion of this subject following Mr. Clarke's paper. Mr. H. A. Kroeze, Trustee of the Section, presided at the afternoon meeting.

President and Vice-Pres. on Hand

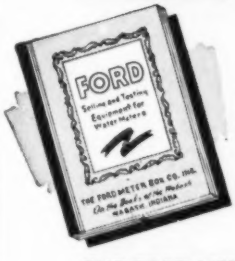
We were doubly honored at the banquet that night by the presence of both President Linn H. Enslow, who flew in from Texas, and Dr. Black, Vice Pres. of the Parent Association. After brief comments Mr. Enslow made the announcement that Mr. A. N. Beck, Chairman, had been named as recipient of the Fuller Award and read the citation. Dr.

. . . for DOUBLE SAVINGS

The FORD COPPERHORN

The Ford Copperhorn for vertical lines provides TWO important savings . . . . first in original settings and then, later, whenever changes or replacements are necessary.

At the time of the initial setting, only two pipe fittings are required, one above and one below. These fittings are not disturbed when meters are changed . . . . all that is necessary is a few quick turns of the meter coupling nuts and the job is done.



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FORD

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Black, the scheduled speaker, discussed "A.W.W.A. Affairs." After the banquet, members were entertained with a fascinating demonstration by the "Great Brandino," magician extraordinary.

The final day of the meeting was begun by A. O. Norris, Vice-Pres. and Genl. Mgr., Birmingham Water Works Co., Birmingham, Ala., who presented a paper on the important subject of "Financing Distribution System Extensions." Panel discussion of this topic was led by E. L. Myers, Supt. of Water, Jackson, Miss.

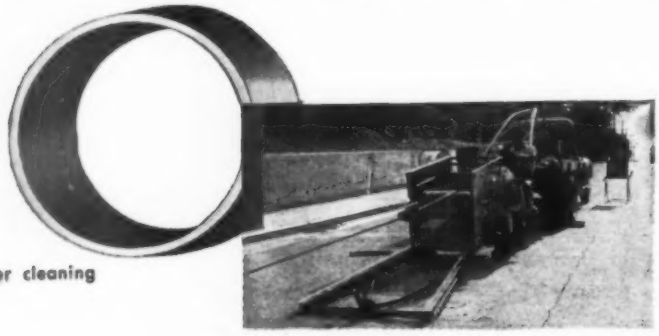
[Note—Mr. Norris' paper will be printed in full in the February issue of *Water & Sewage Works*.—Ed.]

A feature of the technical sessions was the excellently presented papers and the spontaneous, instructive, and interesting discussions which resulted.

The 23 ladies attending enjoyed a theater party, motor trip through the city, visit to Rosemont Gardens, the South's Leading Florist, and a beautiful luncheon at the famed Blue Moon Inn.—*J. L. Snow, Sec'y-Treas., Ala.-Miss. Section.*

Before cleaning

A CLEANING JOB THAT LASTED 30 YEARS



After cleaning

Special Power Winch for pulling cleaning head through pipe.

Just 30 years ago the water mains of the city of Toledo, Ohio were successfully cleaned by National.

The thoroughness with which National performed that initial job, along with the exceptionally fine water treatment system installed by Toledo's Water Works Department has enabled the original cleaning to last *30 years*.

It was because of that unusual record that Toledo's progressive water works department *has again selected National* to clean its entire water main system—a program that will take over five years to complete.

Tests made on those lines already cleaned by National indicate higher pressure and increased carrying capacities, resulting in greater fire protection for Toledo's outlying districts.

There's no obligation to have a National engineer estimate the cost of cleaning your lines. Why not write *today!*

30

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Annual Reports of Interest

The following brief abstracts have been made of annual reports received within recent months. Copies of the reports may be obtained by writing to the superintendent of the department or plant in question.

WATER SUPPLY

The following review of the Annual Report of Little Rock, Ark., for 1947 was originally published in our October, 1948, issue, but the figures quoted for Operating Revenue and Expenses were incorrect and, for that reason, this report is repeated with the correct figures.

Little Rock, Ark. 1947 (85 pages). L. A. Jackson, Mgr.-Engr. Capital expenditures during the year for extensions and improvements amounted to $388,935 as compared to $621,810 the previous year. To meet increased consumption demands, plans were begun to increase the capacity of the filter plant from 15 to 23 mgd. Total operating revenue was $897,200, Operating Expenses $351,501, Net Income $341,224, Consumer growth continued; 1,411 consumers being added during the year, for a total increase of 48 percent since the city took over the management of the Water Department in 1936. Water Department operates a fish-rearing pond; the fish, generally bream and bass, are removed and distributed throughout the state. Average daily pumpage 128 mgd.

SEWAGE TREATMENT

Jackson, Mich.; 1947-48 (24 pages). Superintendent, R. A. Greene. Plant facilities described. 8.29 mgd. flow. Suspended solids, 199 ppm.; B.O.D. 119 ppm. Total removal of suspended solids 94 per cent. Removal of B.O.D. 97 per cent. Suspended solids and mixed liquor 2,420 ppm.; per cent sludge returned 17, sludge index 53. Solids reduced in digesters, 26 per cent. Volatile matter reduced by digestion, 43 per cent. Population 50,000. Cost per mgd. of sewage treated, $28.33. Including fixed charges, $44.77.

Cleveland, Ohio. 1947. (54 pages) J. W. Ellms, Commissioner, Division of Sewage Disposal. Total operating expense $1,052,051. Net operating revenue $291,928. Total plant operating costs for 4 plants, including easterly, southerly, westerly and ejector stations, $905,969, of which

(*Continued on page* 84A)

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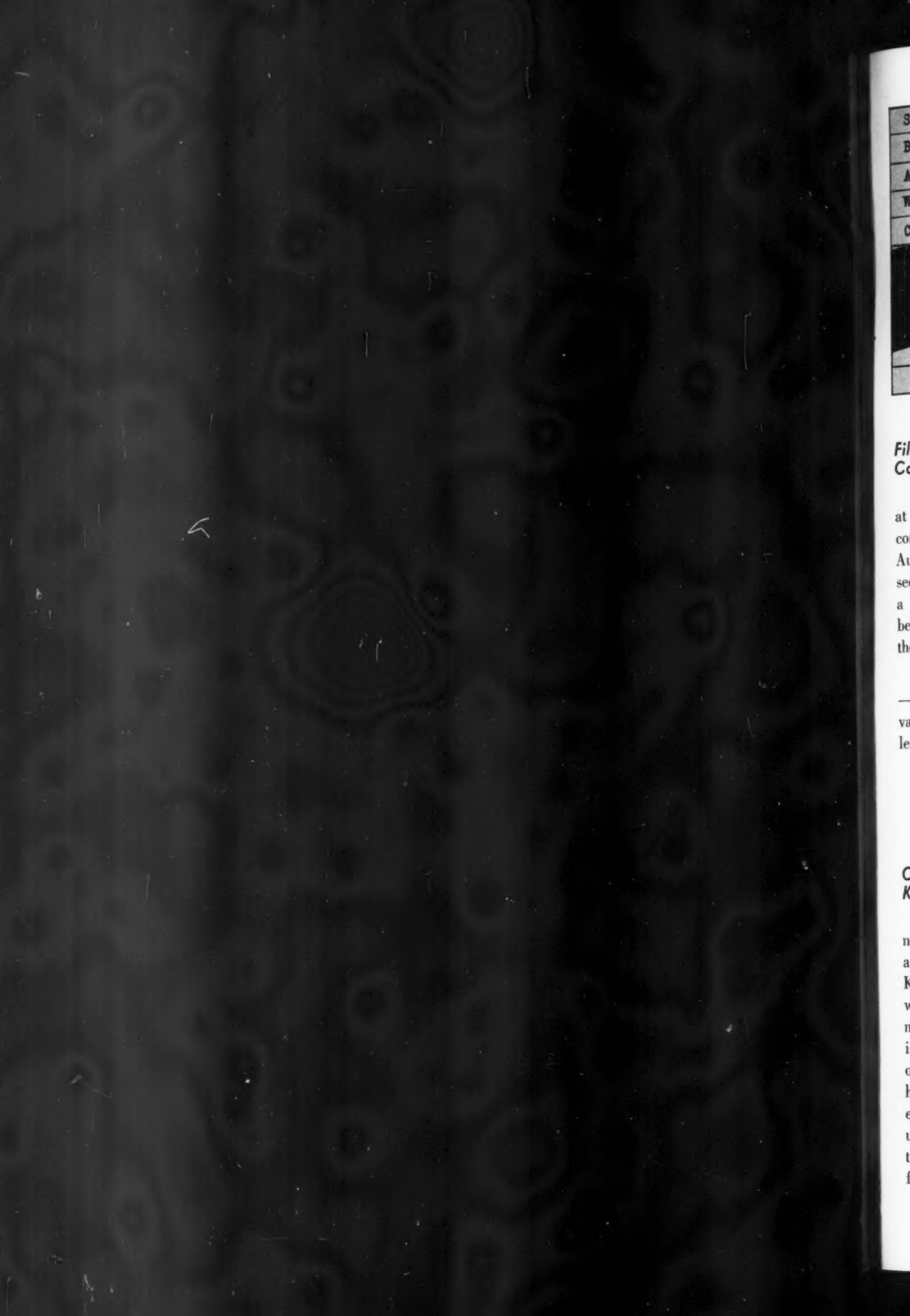

SURFACE WASH -- AUTOMATIC BACKWASH FILTERS -- ACTIVATED ALUM -- ZEOLITE
BLACKALUM -- KWIK-WAY MIXER FLOCULATORS -- FILTER SAND
AUTOMATIC SLUDGE REMOVAL -- FILTER BOTTOM
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SAND
VALVES -- AMMONIA
WATER SUPPLY CONTRACTORS -- GRAVEL
-- OVER-HEAD
SULFATE OF ALUMINA -- AER
WHAT'S NEW in WATER WORKS
details this adv. STUART CORPORATION 516 N. Charles St Baltimore, Md.

Filtering Water Continuously

A 10 million gallon water plant at Lock Haven, Pa., filters water continuously using the Hardinge Automatic Back Wash Filter. The secret of this filter is that it washes a 10 in. section across the filter bed at a time instead of taking the whole filter out of service.

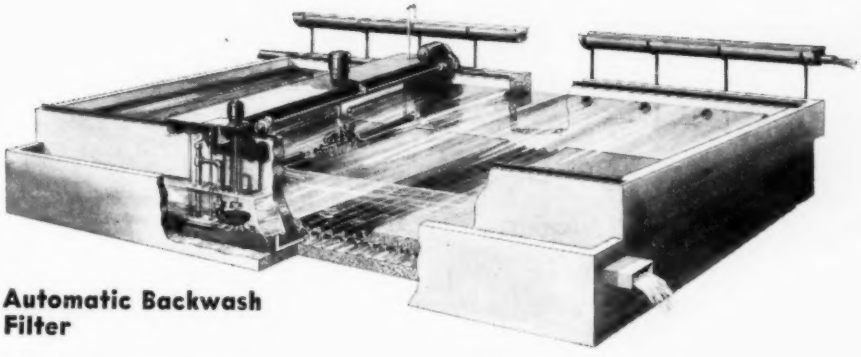
There is no loss of head gauges —no operating tables—no 4-way valves—no rate of flow controllers.

Write for literature

Cornell University Selects Kwik-Way Mixer Flocculator

The new addition to the Cornell University Filter Plant (Ithaca, N.Y.) has an overhead drive Kwik-Way Mixer Flocculator, with all of its under water parts made of Everdur Metal. This unit is the walking beam type developed by Stuart Corporation and has no bearings, chains, sprockets, or moving parts of any kind under the water's surface, similar to the Norfolk, Virginia, and Suffolk, Virginia installations.

Write for details

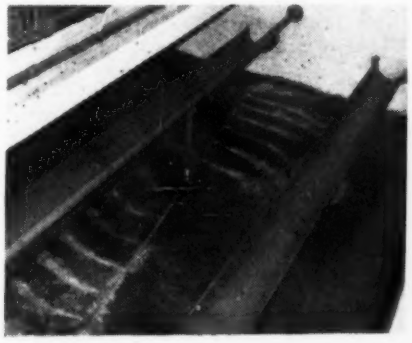


Automatic Backwash Filter

More Cities Adopt Surface Wash

In the past few months, the Cities of Hagerstown, Annapolis, and Frederick, Md.; Miami, Fla.; Lancaster, Pa.; Portsmouth, Va.; and Burlington, N.C., have all adopted the rotary Surface Wash System of Stuart Corporation (The Palmer Filter Bed Agitator). Surface Wash offers many advantages for more economical operation and for better tasting water because the filter sand is really cleaned. Stuart Corporation makes complete installations of Surface Wash Systems.

Write for details— No obligation



Rubber Flight Conveyors

A new conveyor, which contains rubber flights, was introduced to the field during war time. It operates on a chain, running inside of a standard 4″ or 6″ pipe. It will follow bent pipe anywhere—will operate in more than one plane. In other words, it will go up from one room to another and then go upstairs and then return to its original starting position. Designed for carrying abrasive materials including sand —effective for keeping dry-feed machines continuously filled; also for removing sludge; also for grid chambers; also for handling coal.

Write for details

Water Works Association Meets in Chicago

Annual Convention of the American Water Works Association meets in Chicago on May 30-June 3.

Don't forget to make reservations now.

$220,396 was maintenance and the remainder general operating costs. Report breaks down costs between the various plants. Cost per million gallons of operation at easterly plant $17.31, at westerly plant $15.20, at southerly plant $15.71. At the easterly plant where complete treatment is afforded, the suspended solids removal is 49.8 percent, B.O.D. removal 95.5 per cent. Flow diagram of easterly plant is shown, and general plant layout of westerly plant is shown. Complete data on analysis and operation of all three plants are given.

Philip Morgan Joins Univ. of Iowa Engr. Staff

The State University of Iowa, College of Engineering, Iowa City, has announced the appointment of Philip F. Morgan as Associate Professor of Sanitary Engineering. Mr. Morgan, who holds a B.S. and an M.S. in Civil Engineering from the University of Wisconsin, has been Development Engineer for the National Council for Stream Improvement, in charge of the Council's Pilot Waste Treatment Plant Project, particularly at Kalamazoo, Mich., Nashua and Fitchburg, Mass., and Terre Haute, Ind.

Prior to his work with the National Council, which he began as a Fellow at the Mellon Institute of Industrial Research in August, 1945, Mr. Morgan was the Manager of the Sewage Equipment Engineering Dept. of the Chicago Pump Co., from 1941 to 1945.

TYPE A PEERLESS PUMPS

TYPE A for

All purposes. For widest variety of general services. Handle water and alkaline fluids where no solids are in suspension.

Advanced design. Double suction, single stage, horizontal split case construction. Ball bearing type. Dayton-Dowd design.

All capacities and heads. Sizes 1¼" to 48". For capacities up to 70,000 g.p.m.; heads up to 300 feet; temperatures up to 250 F.

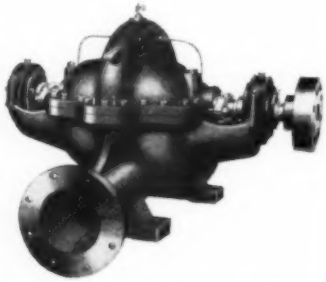
Ample safety factors. Component parts designed to afford high safety factor in operation and to extend pump life.

Accuracy in construction. All parts machined to gauge on an interchangeable part system. Rigidly inspected in process.

Augmented service life. Fully tested in Peerless' modern hydraulic laboratory to assure meeting or surpassing customers' application requirements.

FOR GENERAL PURPOSE PUMPING

When there's a pump in your plans, plan with a Peerless Type A General Service pump. Because of the large ranges in size, from 1¼" to 48", the widest range of applications is possible. There is a Type A pump with the capacity rating, head characteristics and type of drive to meet the requirements of most water pumping services in all industries.



Write for Bulletin describing and illustrating the design and the application of Peerless Type A pumps.

fmc PEERLESS PUMPS

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MANUFACTURERS' and EQUIPMENT NEWS

PUROMAT CO.

New Equipment Sales And Service Company

PUROMAT CO., a new company formed on October 1, 1948, designs and builds automatic equipment for the water treating and process industries, in cooperation with consulting engineers and with manufacturers of pumps, valves and other standard parts.

This new company is selling chemical feed pumps for chlorine solution, the Alhydro Floc Producer, and other feeders for coagulating and softening reagents. It is also presently developing additional, full-automatic control equipment for clarifiers, softeners and reactors, including a new type of proportional sludge removal equipment. Another development, just completed, relates to cycle controls for softening and demineralizing equipment of the zeolite type, with emphasis on positive, electric drives, minimum headlosses and interferences between hydraulic flows, full protection against power failures, and simplicity of installation and mainte-

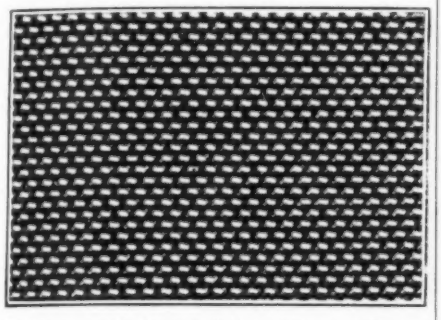
nance. Equipment of this type is also offered for different types of filters.

Frank D. Prager, previously with Graver Tank & Mfg. Co., is president of Puromat Co., which has offices at 59 East Van Buren St., Chicago.

1

Nylon Filter Cloths

Filtration Engineers, Inc., 155 Oraton St., Newark 4, N.J., has announced a new Nylon Filter Fabric, with complete facilities for tailoring Nylon Filter Cloths to fit any make of rotary vacuum or pressure filter or filter press. These new Nylon cloths are resistant to acids, al-



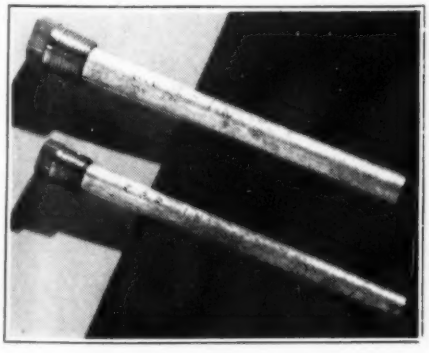
kalies and bacterial action. These Nylon fabrics are stronger and more resistant to abrasion and mechanical abuse, and hence a lighter cloth is used. The life is given as considerably longer than cotton fabrics.

To obtain further information on this new Filter Cloth, use a Reader Service Card on which is entered the above key number and your name and address.

2

Corrosion Inhibitor

Rotometals, Inc., 980 Harrison Street, San Francisco 7, California, has announced the development of COR-IN Corrosion Inhibitors Zinc Rods, which are fitted with standard pipe plug ends.



These screw easily into heat exchangers, or other hydraulic equipment to protect against corrosion. The principle of operation is the use of a sacrificial metal to prevent galvanic corrosion of equipment.

To obtain further information, use a Reader Service Card on which is entered the above key number and your name and address.

Flexible Further Enlarges Los Angeles Plant

The Flexible Sewer-Rod Equipment Co., reports the completion of another addition to their plant of 6000 square feet. Four thousand square feet also was added last year and 7500 square feet added in 1946, making a total of 17,500 square feet added in three years to their Los Angeles plant. They also report new building at their Los Neitos plant of 4000 feet. These facilities which give Flexible a total of 30,000 sq. ft. of production facilities in South. Calif., are now all in use and the Company reports business still at almost peak production.

Philadelphia Quartz Moves Office

The Philadelphia Quartz Co. has announced the removal of its General Offices to the Public Ledger Building, Independence Square, Philadelphia 6, Penna.

LET'S BE SURE!! INSTALL

OMEGA

CHEMICAL FEEDERS

OMEGA Belt Type Gravimetric Feeder.

OMEGA PRODUCTS

Volumetric Feeders • Gravimetric Feeders • Solution Feeders • Lime Slaking Equipment • Bucket Elevators Laboratory Stirrers

The OMEGA Belt-Type Gravimetric Feeder takes the uncertainty and guesswork out of chemical feeding — feeds by weight with 98% accuracy, regardless of whether material is fine or coarse. Almost any water works chemical — lime, ferric sulphate, soda ash, etc., can be fed: material flows from a hopper above and is continuously weighed on a short conveyor belt carried on sensitive scales. Feeding rate can be preset by handwheel over a 100 to 1 range to deliver automatically the exact amount required — from 10 to 10,000 lbs. per hr. Automatic alarms warn of empty bins or improper feeding.

For dust-free operation order an OMEGA Dust Collector with your chemical feeder and eliminate the dust nuisance forever.

Write for Bulletins.

OMEGA MACHINE CO.

(Division of Builders Iron Foundry)

10 Codding Street, Providence 1, R. I.

C. B. Johnson Pittsburgh-Equitable's New Chief Engineer

E. R. Gilmore is Director of Research

The Rockwell Manufacturing Co. has announced the appointment of C. B. Johnson as Chief Engineer of its Pittsburgh Equitable Meter Division. Mr. Johnson joined the company in 1929 as a product engineer.

Announcement was also made of the appointment of E. R. Gilmore as Director of Research for the Pittsburgh-Equitable Meter Division of the company. Mr. Gilmore was formerly Chief Engineer of the meter and regulator divisions of the company.

H. M. Hooker Re-elected to Nat. Ind. Conference Board

H. M. Hooker, Chairman of the Board, Hooker Electrochemical Co., Niagara Falls, N.Y., has been re-elected as a Board Member of the National Industrial Conference Board for the forthcoming year. He was first elected as a board member in 1938. The Conference Board, founded in 1916, is an independent non-profit organization for research in the fields of economics and business.

3

Jet Pump Motors

The General Electric Co., Schenectady 5, New York, has developed a new line of fractional horsepower motors for jet pumps in ratings from ¼ to 1 hp. These motors are adaptable for either horizontal or vertical end mountings. Two lines are available, one with plain shaft extension for coupling to stub shaft, and one with a threaded shaft extension for direct mounting of impeller. These motors are designed for the specific needs of jet pump service.

To obtain further information on this unit, use a Reader Service Card on which is entered the above key number and your name and address.

National Aluminate Opens Philadelphia Office

The National Aluminate Corp. of Chicago has announced the opening of a new office and warehouse in Philadelphia. The new office will be under the direction of A. H. Webber, District Manager. Associated with Mr. Webber will be B. J. Lamb and J. F. Reardon.

FOR WATER SOFTENING . . . TURBIDITY AND COLOR REMOVAL . . . INDUSTRIAL WASTE TREATMENT . . .

The Clariflow

with independently-operated mixing, flocculation, stilling and sedimentation zones

A notable improvement over conventional short-retention water treatment units. Provides individual functioning of mixing, flocculation, stilling and sedimentation zones. • Its control over short-circuiting, control over each function and control of sedimentation through low weir rates mean improved effluent . . . higher filtration rates . . . longer filter runs . . . better industrial waste recovery and treatment.

Write for Bulletin 656

WALKER PROCESS EQUIPMENT INC.
EQUIPMENT • EQUIPMENT ENGINEERING
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4

Impact Nut Setter

Speed-O-Matic Sales, Inc., Illinois Gage & Mfg. Co., 4639 W. Washington Blvd., Chicago 44, Ill., is offering an improved high speed electric impact nut setter.

The new model has capacities from ⅜ in. to ¾ in. bolt size. This unit, which tightens or removes nuts, bolts, studs, and lag screws, can also be used for drilling and tapping. The complete tool is 12½ in. long and weighs only 14½ lb.

For further information, use a Reader Service Card on which is entered the above key number and your name and address.

5

Low Pressure Clamp

The Flexible Tubing Corp., Branford, Conn., has introduced a new and uniquely different type of low pressure clamp for use with flexible conduits.

Known as the Flexfast, this new clamp provides fast, positive clamping action over diameters from 1½ to 37 in., each size having an unusually wide range of take-up. No tools are required for quick and easy set-up or release of this unit.

In place of the usual worm or screw take-up mechanism, Flexfast combines an overlapping one piece non-rusting metal clamping band with a strap and buckle take-up.

For further information, use a Reader Service Card on which is entered the above key number and your name and address.

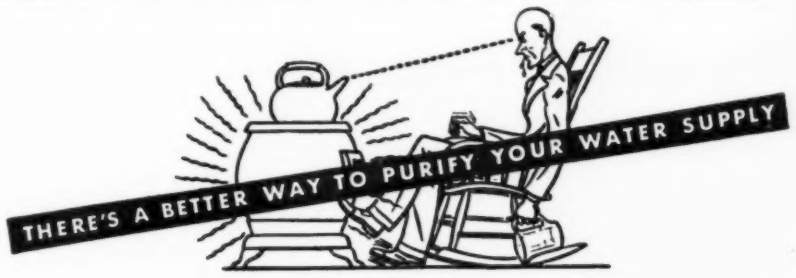
6

Turbine Type Pump

The Roy E. Roth Co., Rock Island, Ill., has announced the development of a new, low cost turbine type pump for liquid transfer. Known as Model 0023, the pump is suitable for industrial applications and furnishes pressures up to 80 lbs., speeds up to 2200 rpm, and capacities up to 8 gpm.

Made of all bronze with stainless steel shaft and double ball bearings, it has a single multivaned impeller, the only moving part of the pump. The unit is claimed to handle condensate without vapor binding. The pump is available with or without motor, base, and coupling.

Further information on this new unit may be obtained by using the Reader Service Card and entering the above key number.



%PROPORTIONEERS%
HEAVY DUTY CHEM-O-FEEDER

Even if the watched kettle never boils you can have safe, pure water with %Proportioneers% Heavy Duty Chem-O-Feeder. This inexpensive, dependable chemical feeder will automatically purify up to a million gallons of water a day. Cross-connected to the starting switch of the main pump motor, the Chem-O-Feeder operates exactly in step with the pump and sterilizes every drop of water. It feeds just the right amount of hypochlorite or other chemical — eliminates the unpleasant taste resulting from overfeeding, and prevents dangerous undertreatment. Write for Bulletin SAN-2.

ADJUSTMENT WHILE IN MOTION. By simply turning a knob which varies the stroking length, the amount of chemical fed can be precisely adjusted while the pump is operating.
CONTINUOUS FEEDING. Unique stroking arrangement gives long feeding stroke and short suction stroke — provides uniform distribution.
"SEE-THRU" PLASTIC REAGENT HEAD. Safely handles all water treating chemicals — shows the movement of the parts and the flow of liquid being fed.
PROVEN DESIGN. Over 24,000 "Proportioneers" units are in use all over the world.

% PROPORTIONEERS, INC. %
9N Codding Street, Providence 1, R. I.

Henry Monroe Now With Proportioneers

%Proportioneers, Inc.%, Providence, Rhode Island, has announced that Henry Munroe has joined its technical staff. Mr. Munroe was formerly associated with Proportioneers' sister company, Builders-Providence, both subsidiaries of Builders Iron Foundry.

7

Safety Aid Dial

The Davis Emergency Equipment Co., Inc., 45 Halleck St., Newark 4, N.J., has introduced a new Davis Safety Aid Dial. This Dial gives safety men a quick reference for many of the daily hazard problems which would take hours of time consulting a number of manuals and text books. There are two sides to the dial, the operation side covers 45 different mechanical operations in industry; suggested head, eye and face protection for each operation, body protection and respiratory protection.

The substance side lists 55 different fumes, vapors, gases, dusts, and

gives the information about the probable safe concentration, suggested protection and control, usual methods of entrance, flash point, lower explosive limit so forth. There are in addition a canister color chart and listing of the uses and limits of various types of gas protective equipment.

If you desire one of these Safety Aid Dials enter the above key number on a Reader Service Card.

"VAREC" *Approved* GAS CONTROL and SAFETY DEVICES *are* INSTALLED!

Figure No. 58C

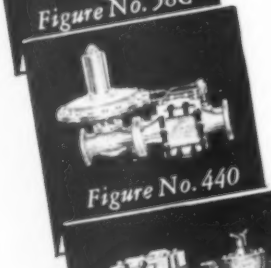


Figure No. 440

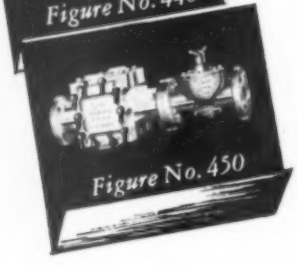


Figure No. 450

No matter what size plant, no matter how much variation in gas volume, there are VAREC Gas Control and Safety Devices that will permit the safe utilization of sewage gas and the automatic burning of waste gas in your sewage treatment plant. This sturdy, foolproof equipment is now specified in all sizes and types of sewage treatment plants.

VAREC Flame Traps, Flame Arresters and Flame Checks are all designed to pass normal gas flow, yet are positive in their flame stopping action. VAREC Supersensitive Regulators can be depended upon for maintaining proper pressures to gas utilization equipment. VAREC Waste Gas Burners are the simple solution to waste gas problems. Write for the latest catalog.

Fig. No. 236

S-6

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.
"Varec"
NEW YORK 30 Church Street · CLEVELAND 1501 Euclid Ave. · CHICAGO 122 So. Michigan Ave. · TULSA 533 Maye Building · HOUSTON 821A M. & M. Bldg.
Available from Authorized Sewage Equipment Agents throughout U. S. and Canada
Cable: VAREC COMPTON (all codes)

Geo. W. Cissna Neptune's Southwest Mgr.

The Neptune Meter Co. has announced the appointment of George W. Cissna as Southwestern District

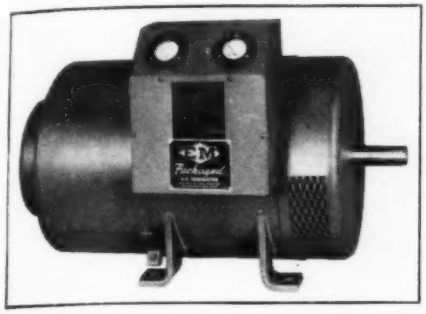
Manager, with headquarters in Dallas, to succeed the late Egmont S. Smith.

Mr. Cissna has been with the company since 1930 and in recent years has represented the company in Georgia and Florida.

8

Packaged Generators

Electric Machinery Mfg. Co., Minneapolis 13, Minnesota, is offering the new Packaged Generator line, with a complete unit of Generator, Exciter and Built-in Voltage Regulating Circuit.

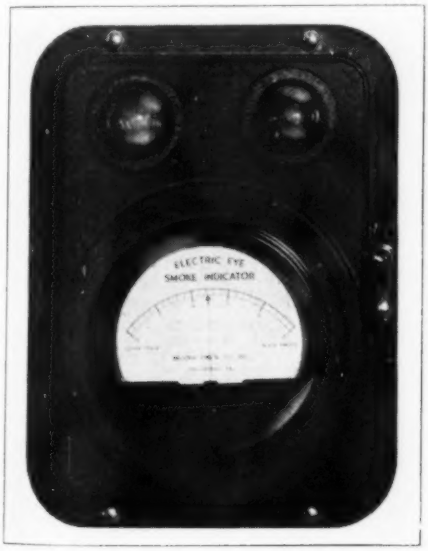


To obtain further information on this new packaged generator, use a Reader Service Card on which is entered the above key number and your name and address.

9

Smoke Control

Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia 44, Pa., offers a new development in the field of automatic smoke control for boilers and industrial coal burning furnaces.



This is an electric eye smoke indicator adapted to control over-fire air to prevent smoke in such furnaces.

For further information, use a Reader Service Card on which is entered the above key number and your name and address.

R. D. Wood's MacCarthy Dies

Vincent P. MacCarthy, Lakewood, Ohio, for many years District Sales Manager for R. D. Wood Co., of

WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE •
FLANGE PIPE •
MECHANICAL JOINT PIPE •
FLEXIBLE JOINT PIPE •
SPECIAL CASTINGS •
SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Speicfications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
11 BROADWAY — N.Y.C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

HYDRANTS & VALVES

Pipe Line Accessories for Water Works and Sewage Works

Write for Catalog No. 34

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H Flap Valve

M & H PRODUCTS INCLUDE

FIRE HYDRANTS
GATE VALVES
TAPPING VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
B & S FITTINGS
CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

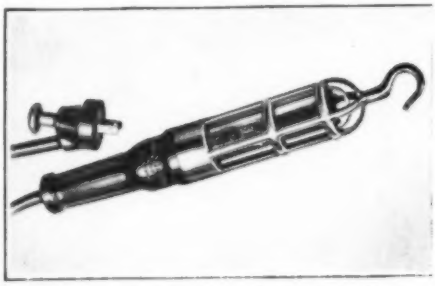
Philadelphia, in the Ohio and Michigan territory, died in November after a brief illness.

Mr. MacCarthy will be succeeded in the area by William A. West of Berea, Ohio. Mr. West has been associated with the company for a number of years and has worked with Mr. MacCarthy.

10

Extension Light

Neoline, Inc., 124 West 4th Street, Los Angeles 13, California, has developed a new type of extension hand light, called the Neogard, which has



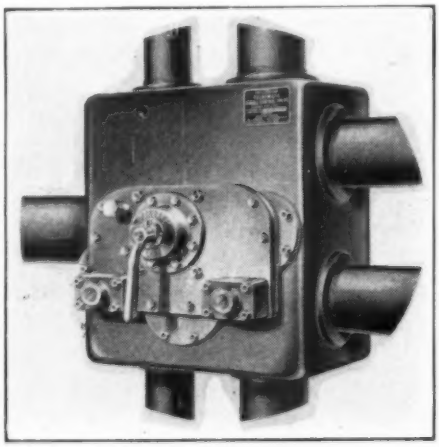
many unusual safety features. It can be used without fear in high voltage work or salt water.

For further information on this unique item, use a Reader Service Card on which is entered the above key number and your name and address.

11

Control Valve for Softeners

The Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, Pa., has developed a new single control valve for the simplified operation of



all types of Zeolite softeners and ion exchange systems and filters, known as the Cochrane Hydromatic Single Control Valve. The unit will control back wash, rinse, service and chemical feed for the operation of Zeolite systems.

To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

L. A. Fritze Retires at Elgin Water Softener

Elgin Water Softener Corp., Elgin, Ill., has announced the retirement of Lucius A. Fritze, Vice President of the organization since 1927. A recognized authority in the field of water conditioning, and a former president of the Water Softener and Filter Institute, Mr. Fritze, as vice-president of the Borromite Co., pioneered the introduction of greensand zeolite. Later he was vice president of Paige & Jones Chemical Co. Mr. Fritze will continue to serve as a member of the corporation's board. He will be succeeded by E. W. Scarritt as Vice President and Director of Sales.

LITERATURE AND CATALOGS

12

METER READING PRACTICE

Remington Rand Co., 315 Fourth Ave., New York 10, N. Y., has issued a 32-page booklet, titled **Modern Meter Reading Practice.**

This booklet has been released by the Public Utilities Dept. of the Systems Division of the company, and describes the latest approved practices in handling of meter readers' records, based on the accumulated experience of the public utility records specialist of the Remington Rand organization.

Included in the booklet are samples of forms used, types of binders, discussion of proper material to be used, and a new development utilizing interchangeable covers for field and office.

A description is also given of the proper use of rate charts and binder racks in the auditing and billing departments, together with illustrations of the latest Remington Rand "Unit-Bookkeeping" safe desks for combining consumer-bookkeeper functions. The booklet is well illustrated.

To obtain a copy of this book on meter reading practice, use a Reader Service Card on which is entered the above key number and your name and address.

The SEWER SCOOTER

(U. S. Patent 2,198,823)

THE ONLY 100% SELF-PROPELLING SEWER CLEANER

THE FLUSHING ACTION IS APPLIED BY COLLAPSING THE SHIELD.

A patented feature

No Preliminary Work—
Gets Results in a Hurry

SEWER SCOOTER MODEL A-3, BRONZE

Standard machines stocked 8 inches to 96 inches—For sale, rent or contract.

J. C. FITZGERALD

Box 289-A
Coral Gables 34, Fla.

13

CHLORINE

Mathieson Chemical Corp., 60 E. 42nd St., New York 17, N. Y., has just published a new booklet entitled **Mathieson Chlorine.** The 36-page booklet is intended to provide information on the proper handling of liquid chlorine.

Included in the booklet are such subjects as the shipment and storage of liquid chlorine with data on Chlorine cylinders, ton containers, and tank cars, methods of handling dry and moist chlorine, safety in the use of chlorine, and first aid for chlorine exposure.

Also contained is detailed information on the physical properties of chlorine, tables and charts listing vapor pressure, density, specific volume, viscosity, specific heat, and surface tension at various temperatures.

To obtain a copy of this highly informative book on Chlorine, use a Reader Service Card on which is entered the above key number and your name and address.

14

AUTOMATIC REMOTE CONTROL

The Grove Regulator Co., 65th & Hollis Sts., Oakland 8, Calif., has issued a 16-page bulletin on the Grove **Flexflo** expansible tube valves.

This bulletin describes the varied manual and automatic remote control applications of these valves. Included in the bulletin are technical data and diagrams of typical arrangements suitable for stop valve, emergency shut-off and release valve, liquid level control, automatic flow controllers of the liquid type, shockless pump control, slow opening and closing check valves, and many other uses.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

BACKED BY MORE THAN A GOOD NAME!

RENSSELAER

Double Disc GATE VALVE
Write for Bulletin X

Our Expert Field Representatives
bring Rensselaer's years of valve research and engineering "know-how" to your field of operations!

Enthusiastic SERVICE
by our factory on large orders or simple inquiries. Our Engineering staff gives cheerful attention to even the smallest valve problem.

Proven LONG-LIFE
Thousands of Rensselaer valves are in constant operation after service for over 60 years.

RENSSELAER VALVE CO.
TROY, N. Y.

The Rensselaer Representative in your locality is ready to serve you.

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HORNELL, N.Y. 38 Main Street
KANSAS CITY, MO. 1609 Oak Street
LOS ANGELES, CALIF. Subway Terminal Bldg.
MEMPHIS, TENN. 822 Dermon Bldg.
MINNEAPOLIS, MINN. 625 Plymouth Bldg.
OKLAHOMA CITY, OKLA. 817 Braniff Bldg.
OMAHA, NEB. 423 S. 38th Ave.
PITTSBURGH, PA. 1404 Oliver Bldg.
SAN FRANCISCO, CALIF. 115 Townsend Street
SEATTLE, WASH. 1252 First Ave., South
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Subsidiary of the NEPTUNE METER COMPANY

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

NO MAINTENANCE IN 23 YEARS

The before and after photos show a reservoir we re-lined with "GUNITE" in 1925 for the Village of East Aurora, N. Y. Recently Mr. V. E. Haemmerlein, Village Engineer, wrote us:

"The job you did of Guniting our reservoir is still in first class condition. Some hair cracks have developed near the top. I drilled one-half-inch holes where some of these cracks showed but find that they are only about one inch deep. They do not go beyond reinforcing. We have had no maintenance whatsoever."

We can similarly solve your problem if you have an old leaky or disintegrated reservoir. We invite you to call on us for complete information, recommendations or estimates on any "GUNITE" work which you may be planning.

Our 64 page bulletin C2400 describes this job and scores of other profitable uses of "GUNITE." Write for your free copy today.

FEED-METERS-MIXES CHLORINE GAS ACCURATELY

SterElators by Everson

PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction. NO JOB TOO LARGE

Send us Copy of Specifications

SterElators by Everson

EVERSON MFG. CORP.
233 W. Huron Street
Chicago 10, Ill., U. S. A.

How to join *more* bell and spigot cast iron water mains *per hour* ...*at less cost*

ELIMINATE USE OF HIGH PRICED LEAD

Haymanite JOINTING COMPOUND

High lead prices needn't bother you anymore. Use Haymanite. It's inexpensive—goes 4 times as far as lead. Saves 75% of costs.

- Saves time.
- Requires less fuel.
- Reduces handling and transportation.
- No large bell holes.
- Self-sealing if broken.

Immediate Deliveries from stock
Free illustrated catalog

Producers also of M. H. Brand Caulking Lead.

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST., BUFFALO, N. Y.

15
WASTE TREATMENT

Link-Belt Co., Chicago, has included a story in its October issue of **Link-Belt News** on the treatment of glue manufacturing waste to recover grease. A complete story of the operations, including a diagram of the equipment, is shown. As usual, **Link-Belt News** carries another picture of the attractive Claire.

To obtain a copy, use a Reader Service Card on which is entered the above key number and your name and address.

16
VALVE BOXES, ETC.

Bingham & Taylor Corp., 1401 Jefferson Davis Highway, Arlington, Va., have issued a bulletin on valve boxes and other service equipment.

Included in the catalog are data and information on the Buffalo Screw and Sliding Adjustable Service, Roadway Valve, Test Valve, Gas Drip, Meter, Vent, Manhole Valve Vault Boxes, Manhole Frames, Covers, and Special Boxes of any and all description.

A copy of this catalog may be obtained by using the above key number and your name and address on a Reader Service Card.

17
CENTRIFUGAL PUMP

The De Laval Steam Turbine Co., Trenton 2, N. J., has its published Catalog No. 83-29 on the **De Laval Single Stage Centrifugal Pump.** This bulletin is a comprehensive catalog presenting the various features of De Laval design and construction, and listing pump ratings and essential dimensions. The bulletin replaces several separate leaflets on these various pumps and this one catalog now contains information for all G, I, K, L, M and P single stage, single and double suction pumps. It gives brief descriptions of various features.

To obtain this catalog use one of the Reader Service Cards included in this magazine. Be sure to fill in the card completely.

18
SEWER SEAL

The Products Research Co., 1019 S. La Brea Ave., Los Angeles, 35, Calif., has issued a bulletin on its product known as **Sewer Seal.**

Called Sewer Seal Type "A", this bulletin describes the material which is a synthetic rubber sewer sealant developed by the company.

The bulletin contains information on the composition, properties, and

LEADITE

The Pioneer Self-Caulking Material for C.I. Pipe

4 REASONS

why more miles of cast iron water mains are jointed with LEADITE than with any other melted self-caulking material:

- MELTS EASILY
- GOES FARTHER
- SAVES TIME, LABOR, COST OF MATERIAL
- MAKES A GOOD TIGHT JOINT THAT IMPROVES WITH AGE!

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

direction for use, as well as information on its application to liner plate filleting of tile lined sewers and vitrified clay pipe joints.

To obtain a copy of this bulletin on this new Sewer Seal product, use a Reader Service Card on which is entered the above key number and your name and address.

19

HYDROCRANE

Bucyrus-Erie Co., 7923 W. Greenfield Ave., Milwaukee, Wis., has issued a folder on the **Bucyrus-Erie 2-Ton Hydrocrane.** This is a full hydraulic crane with a small crane mobility and big crane utility. It is completely hydraulic with a telescopic boom, giving utmost simplicity. The truck engine powers the crane as well as the truck. It is mounted on a 1½ ton truck and designed for small scale jobs which normally require slow and costly hand labor. The Hydrocrane has been effectively used in trenching, back-filling, and for other purposes, and in laying water and sewer pipes.

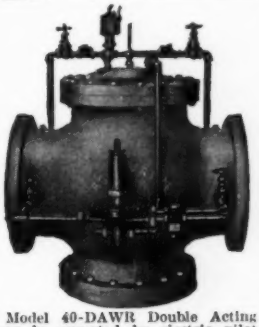
To obtain a copy of this folder, which describes the Hydrocrane, use a Reader Service Card on which is entered the above key number and your name and address.

Est. 1879

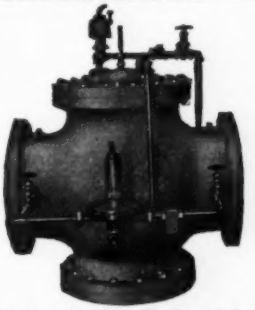
ROSS

AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

ROSS VALVE MFG. CO.
Incorporated
P.O. BOX 595, TROY, N.Y.

FOR BETTER

pH Control

and WATER TESTS

there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE

INCORPORATED

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HEADQUARTERS FOR COLORIMETRIC APPARATUS

Easy Way To Clean Tiled Walls

REMOVING stains from sewage-plant tiled walls needn't be a long, haphazard affair. Specialized Oakite tile-surface cleaners readily remove gritty films, dirt and stains . . . leave surfaces glossy and clean . . . may be used, in recommended solutions, over and over without danger of attacking expensive ceramics. If you want complete tiled-wall cleaning data, drop us a card. Or check with the Oakite Technical Service Representative nearby. No obligation, naturally.

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73 Thames Street, NEW YORK 6, N. Y.

Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE

Specialized Industrial Cleaning

MATERIALS • METHODS • SERVICE

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COUNTY
MUNICIPAL
AND
INDUSTRIAL WATER TOWERS

SPEELMON ELEVATED TANK—SERVICE

COMPLETE PAINTING AND REPAIR SERVICE

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BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

BAILEY METERS

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

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Bailey Meter Co. Ltd., Montreal, Canada

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The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.

Sales Office: 140 Cedar St., New York, N. Y. Factory: Medford, N. J.

Pioneer Producer of GREENSAND ZEOLITE MINERAL

20

YARNING MATERIAL

The Rice-Chadwick Rubber Co., of Killbuck, Ohio, has issued a four page bulletin on the **Flexo-Pac** yarning material. This is the pioneer rubber packing for yarning joints on bell and spigot cast iron water pipe. The bulletin shows actual sizes and dimensions of the wedge type Flexo-Pac, and the round type Flexo-Pac.

If you desire a copy of this folder enter your name and above key number on a Read Service Card and mail.

21

PLASTIC COATING

The Gregg Co., 1418 Walnut St., Philadelphia 2, Pa., has a loose-leaf file folder on **Plastic Coating for All Purposes.**

This folder contains information on the Nu-Type plastic coating as manufactured by this company. Included in the folder are data and information on thermoplastic coating, plastic flooring, and a half dozen other special Nu-Type coatings developed for particular uses, many of which have applications in water or sewage plants, where corrosion of surfaces is a factor.

A copy of this bulletin may be obtained by entering the above key number on a Reader Service Card.

22

SEWAGE SAMPLERS

Infilco Inc., 325 W. 25th Place, Chicago 16, Ill., has a bulletin on **Sewage Samplers.** This bulletin describes the operation of the Automatic Sampler which gives accurate compositing, punctual sampling, and automatic refrigeration in the unit. The unit itself is described and its installation is diagrammed.

WANTED: Chief Chemist, experienced in sewage plant operations and laboratory techniques. A young man with a thorough knowledge of sewage analyses, capable of managing a pilot plant installation is needed. Allegheny County Sanitary Authority, 502 City-County Bldg., Pittsburgh 19, Pa.

NOTICE TO BIDDERS

The City of El Segundo offers for sale on bid:

(1) Two 50 gallon per minute, Pneumatic Ejector Sewer Pots, complete with 15 H.P. motor, compressor, compensator and valves

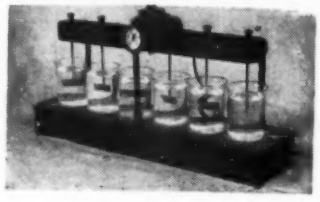
(2) Two 50 gallon per minute, Pneumatic Ejector Sewer Pots, complete with 5 H.P. motor, compressor and compensator (one equipped with valves).

Bids may be on any one or more of the above items and must be placed with the City Clerk of the City of El Segundo prior to 7:15 P.M., *January 12, 1949.* For details and bid forms, contact the office of the City Engineer, 209 West Franklin Avenue, El Segundo, telephone number El Segundo 27.

Paddock Sales of Texas

Sales Agent for Paddock Engineering Company of Texas

3727 Atwell St. Dallas 9, Texas • M & M Bldg., Houston 2, Texas



Phipps & Bird

LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

EDSON

DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
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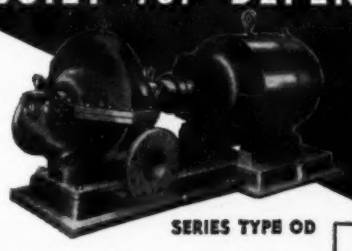

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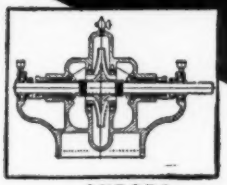

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The American Car and Foundry Co., 30 Church Street, New York 8, N. Y., has just issued a bulletin on **A.C.F. Plug Valves.** This 32-page bulletin not only shows the construction of the A.C.F. Plug Valve, but also shows pictures of all the various types of valves in the various weights and types of steel, as well as multiport valves, aluminum valves, brass valves, etc.

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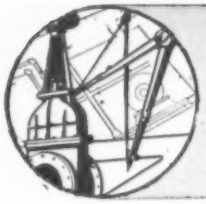

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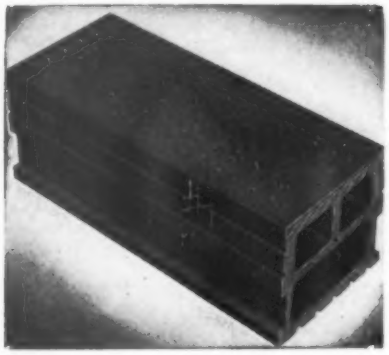

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*Advertisers with * were represented in the April, 1948, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on behalf of their products.

DORRCO DOINGS IN 1948

1948 has been a year of gains and losses. The greatest overall gain, I believe, has been the definite actions which have clarified the world situation and brought a magnificent response at home—a response which indicates that, almost unanimously, we recognize the fact of one world. Truly may it be said that what is the concern of one must be the concern of all.

As to the future, I am reminded of the reply of the elder J. P. Morgan who was asked by a young man whether he knew what the market would do: "Yes," said Mr. Morgan, "it will fluctuate!" I think we can safely conclude that, whatever the trend today, the prospect of "Peace or War" will fluctuate for the next ten years or longer and we shall have to make the best of it. I believe, however, that the swing will be longer and longer toward the side of peace.

* * *

EUROPEAN ASSOCIATES— Many will be interested in knowing we have acquired a new home in Amsterdam—a 300 year old building of one of the old merchant princes. Owing to housing difficulties abroad, we will have rooms there, like the flats we maintain in London, available at times for friends in trouble.

All of the Dorr-Oliver companies in Europe have advanced and prospered in 1948 and gotten over the hump of the production problems which plagued them last year. Outstandingly large accomplishments were the supplying of numerous dewaxing filters for European oil refineries; the furnishing of processing equipment for titanium pigment manufacture in England and India; and the equipping of a number of cement mills in Western Europe.

CLASSIFICATION— The Classifying field for us is expanding with our acquiring the license and selling rights here in America for the Hydro-Cyclone of the Dutch State Mines for general use. It shows good possiblities for special classification conditions. We are also working on a development which should show the value of combined hydraulic and mechanical classification and its effect on grinding and flotation efficiencies.

SUGAR CANE & SUGAR JUICE— At the Waialua and Ewa Factories in Hawaii, the earth-laden water from the operation of cane washing, necessitated by "grab" harvesting, is passed to a Dorr Hydroseparator which yields a satisfactorily clear water for re-use and a thick sludge of soil and water for return to the fields.

To the famous Central Casa Grande in Peru has been delivered a duplicate of the world's largest cane juice clarifier—a 40 foot diameter Multifeed with 5 compartments. The first unit of this size is in operation at Chaparra of the Cuban American Sugar Company.

NON-METALLIC MINERALS— Florida phosphate is highlighted by the first installation of a new, heavy-duty, Dorr Hydroseparator and the installation of a 300 ft. Dorr Thickener in an earthen basin 750 ft. in diameter. The additional area in the latter case will slowly collect small quantities of ultra-fine slime particles which, it is believed, may not have to be removed during the life of the mining operation.

MUNICIPAL SANITATION— A successful, full-scale demonstration of the use of the Dorrco Vacuator ahead of sedimentation at Palo Alto removes the scum problem for plants where the amount of cannery waste does not exceed that of domestic sewage. This invites cooperation between industry and municipal plants. At the Hyperion plant in Los Angeles, our most recent Dorr Digester will be installed in 110 ft. tanks for primary digestion.

Our Biofiltration System of sewage treatment, used so widely during the War, is being adapted for peace-time plants with capacities up to 25 million gallons per day. The latest goes to Cobourg, Ontario.

CEMENT— Much has been done in cement plants the world over, including France, Belgium, and the Argentine. Two of the most modern plants in this country, completed this year, employ complete Dorr C.C.G. Systems, consisting of two stages of closed-circuit grinding, slurry thickening and slurry mixing.

COAL, CHROME & COPPER— The South's first, large, modern coal-cleaning plant, near Birmingham, is to use Dorr Hydroseparators and Thickeners, while a large middle western plant for leaching chrome sinter is to have two of our continuous countercurrent systems—one, consisting of four, large three-deck Dorr Washing Classifiers, for the coarser fractions and the other, consisting of five stages of decantation in Dorr Thickeners, for the finer fractions.

The great demand for copper has necessitated new plants and remodeling of old ones, and Dorr equipment has been largely in demand, including Classifiers, Bowl Classifiers, and large Thickeners.

FLUOSOLIDS & CONSULTING ENGINEERING— Two more Dorrco FluoSolids Systems have been placed under contract this year—one, now nearing completion, for a 100 ton a day lime calcination operation and the other for roasting daily 65 tons of arseno-pyrite gold concentrates. Our consulting staff, in addition to FluoSolids design, has worked on many diversified projects—a 2500 ton flotation mill, phosphate fertilizer plants, an alumina plant and magnesia from sea water investigations both here and abroad.

* * *

During the past summer, I combined a visit to our European associates with joining a small group that toured over 5,000 miles in a station wagon, visiting staff, offices and installations in order to obtain material for a colored film—"The Story of The Dorr Company". These visits ranged from Boliden in North Sweden to Venice. The warm cooperation met everywhere and the closer association with our own staff in Europe emphasized the essential unity and good will existing today across the Atlantic.

A three months' trip around the world made by one executive and a five months' trip made by another, covering the countries of Central and South America, together with frequent exchange visits of technical staff, all assist in our vision of "Dorrco World Wide!" This is evidenced by the visits to our offices, and especially "Westport", of technical men from all parts of the world.

To our friends and to Dorr staff and associates we send New Year's Greetings and with them an expression of our strong faith in the future.

John V. N. Dorr

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"The Only Safe Sewage Is A Sterilized Sewage."

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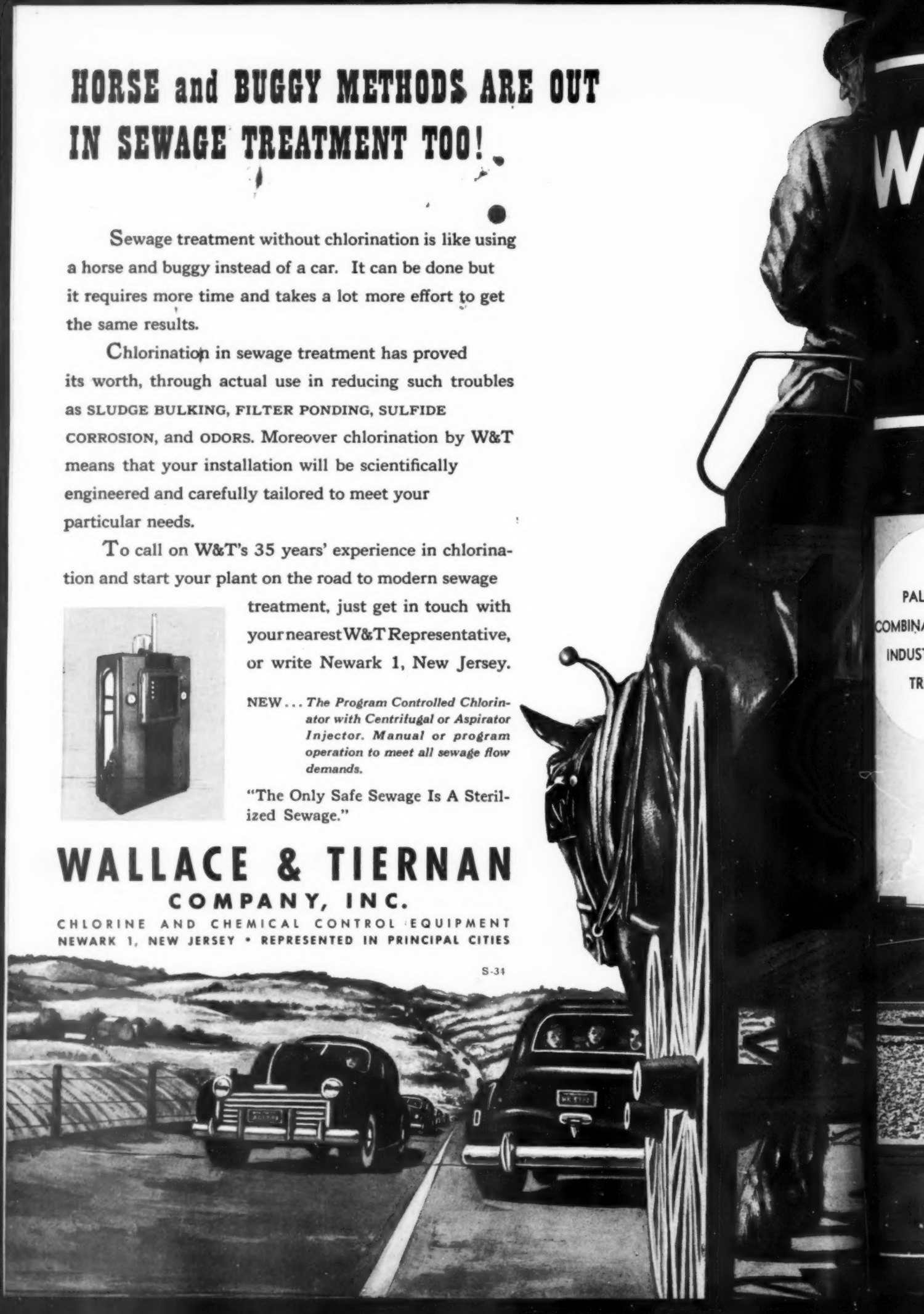
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

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